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CONTENTS.

Editorial 1015
Indiana Telephone Convention..... 1018
An Electric Plow Plant a Failure..... 1018
Chicago Meeting of Illuminating Engineering Society for May..... 1018
Lead-Eating Grubs in Chicago Stockyards..... 1019
Prevention of Sparking in Single-Phase Motors..... 1019
Electric Refrigeration at Thompson's Spa, Boston..... 1020
Methods of Electric Lighting for Railway Trains..... 1020
Electric Trunk Line Operation..... 1020
Current News and Notes..... 1022
Hydro-Electric Developments on the Catawba River, South Carolina 1025
Economical Conductor Section. By Frank G. Baum..... 1029
Voltmeter Compensator for Direct-Current Circuits. By F. E. Haskell 1031
Automatic Calling Device for a Wireless Telegraph Station. By W. R. Carroll 1032
The Technical Man and Simplified Spelling. By Tracy D. Waring.. 1033
Preservation of Line Poles..... 1035
New Telephone Patents..... 1036
LETTER TO THE EDITORS:
N. E. L. A. Trade Exhibitions. By Chas. L. Jameson..... 1036
Digest of Current Electrical Literature..... 1037
Book Review 1040
Electrical Equipment of a Pulp and Paper Mill..... 1040
Electric Glue Pots in a Large Bookbindery..... 1041
Conduit Clamps 1042
Central Energy Automatic Telephone System..... 1042
Construction of the Northern Milwaukee Railway..... 1042
Industrial and Commercial News..... 1043
General News 1046
Weekly Record of Electrical Patents..... 1053

THE WASHINGTON CONVENTION.

From the details that have already been given in these columns, our readers will have learned that the approaching convention of the National Electric Light Association at Washington will be of unusual interest and importance. Held at the National Capital at one of the most attractive seasons, the occasion is assured of success in the matter of attendance, and what is equally significant to the delegates and their friends, the fact that Congress has risen helps to ensure ample hotel accommodation of a good character. Moreover, this year there is the Jamestown Exposition so near at hand as to help bring together members from far away points, especially those of the Southern and Central States, to whom the seashore is an almost irresistible lure in the summer months. But the association now about to hold its thirtieth meeting can always depend for success upon its own attractions, and these as the preliminary programme has shown are of a high order this year. The programme is, indeed, almost bewildering in its variety and profusion, like a three-ring circus, but the association has executive and driving power enough within it to ensure an easy swing through the week's exercises. Perhaps there never was a time when the electric lighting art had more new ideas, devices, lamps and principles presented to it, and apparently all these will come in for consideration that first leafy week in June. In addition to all the technical questions, moreover, the association is to give itself up bodily and throw itself solidly, for one whole day, on the pertinent and vital questions of business getting.

It becomes us to enlarge upon the fact that the association more than ever belongs to the small central station companies, and has become their organ and mouthpiece. This was inevitable with a rapid growth in membership and altogether to be desired. The great central station corporations of the day are really self-sufficient—not in the conceited sense of the phrase but because their energies are of so wide a scope. But the smaller company must learn from others, and nowhere can it learn better than within the ranks of the association membership. The big companies are glad to enjoy the fellowship of these lesser organizations, and the weight of effort to increase the membership is being wisely thrown upon the smaller companies, still some thousands in number, that should unite for mutual support and for the interchange of information and experience, under the time honored banner of this useful and influential association.

SIMPLIFIED SPELLING.

Elsewhere we print an article by Mr. Tracy D. Waring in advocacy of so-called simplified spelling, the arguments being particularly addressed to men of technical education. Mr. Waring presents his case forcibly, and though much might be

said on the other side with relation to etymological and literary historical objections and to changing pronunciation that may in time render a simplified spelling obsolete from the phonetic standpoint, we leave it to our readers to form their own verdict as to the merits of the case. As to the position of this journal in the matter, it will continue to adhere to the spelling which has the sanction of general good usage; for its purpose is to present in the clearest manner the knowledge of its special field, which purpose would not be furthered by the use of word forms that, until they have passed into general use, would merely be a source of mind distraction in reading.

Effect of Rated Speed on Alternator Design.

One of the most useful constants employed in the design of electrical machinery is the "output coefficient," which is based on the assumption that the permissible output rating of any one of a line of machines varies directly with the product of the armature and the peripheral speed of the revolving member; or, in other words, that the output of a certain design varies directly with the rotative speed. It is evident at once that such a "coefficient" must be limited in its application to the ranges between which neither disturbing mechanical nor electrical difficulties are encountered. A limit for all types of machines is found in the centrifugal force to which the rotating member is subjected at high speeds, while with direct-current machines an additional, and usually lower, limit is reached at the speed above which the commutation ceases to be satisfactory. The latter limit may be largely removed by the employment of auxiliary poles, so that it may fairly be stated that the limits applying to direct-current generators of the commutating-pole type are the same as those reached with alternators, namely, the permissible temperature rise, the safe centrifugal stress and the electrical limits of the desirable performance characteristics.

Messrs. H. M. Hobart and A. G. Ellis have recently reported the results of an analysis of the constructive material and operating characteristics of a number of machines consisting of one 300-kw, one 400-kw and two 500-kw turbo-alternators, which have actually been constructed, and of four 400-kw turbo-alternators of various speeds that have been designed but not built, from which the authors conclude that for each output there is a certain rated speed which is most favorable to the design as regards both economy and quality. The results reported seem to indicate that for 400-kw, 50-cycle turbo-alternators with revolving fields, the most advantageous speed is 1500 r. p. m. Without questioning the accuracy of the analysis of the authors, it should be pointed out that the conclusions are not general in their application but must be limited to the exact types of machines compared. One of the most important developments in turbo-generator design which has been introduced within the past few years, is the complete enclosing of the machine, primarily to eliminate the noise from the generator room. The enclosure of the generator necessitated the adoption of some forced cooling method, and it has been found that not only is the output not decreased by encasing the machine, but it can actually be greatly increased by using an adequate flow of air. In the analysis given above, the authors seem not to have considered this latest development.

In discussing the economy of material and the operating characteristics of various designs of high-speed alternators, it is necessary to remember that the designer is limited to certain definite speeds. Thus a 25-cycle alternator can be built for 500, 750 or 1500 r. p. m., but for no intermediate or higher speeds. If the revolving member of a 750 r. p. m. alternator is designed for the highest allowable centrifugal force, and a similar 1500 r. p. m. alternator design is based on exactly the same centrifugal force, then the latter machine will have a much less peripheral speed than the former. Since the output varies with the peripheral speed rather than with the rotative speed, other conditions remaining the same, it is to be expected that the alternator of the higher rotative speed will have the smaller output for the same weight of material, or require more material for the same output. The analysis reported by Messrs. Hobart and Ellis, however, was based more upon the change from the four-pole to the two-pole construction than upon a change in peripheral speed.

The Growing South.

It is most interesting to note the remarkable growth of electric power transmission throughout the South. The great plant on the Catawba River described elsewhere in this issue is a capital example of recent activity in developing the resources of the seaward slope of the Appalachian range, one of the richest regions of our country in hydraulic possibilities. Such work is evidence of the steady tendency for the expansion of industry toward districts where power is available without the heavy cost of fuel entailed by long lines of railroad transportation. The movement of manufacturing enterprises southward is very significant in view of the rising price of coal, a movement which is the first symptom of he shift in activity which must accompany depletion of fuel supply. The Great Falls plant is fortunate in commanding a fall higher than is usual on so large a stream, and of capacity enough to ensure cheap operation as well as modest cost of installation. The hydraulic conditions are such as to give a very favorable situation for the power house, especially from the standpoint of good regulation, the wheels being really within the forebay wall. The head of 72 feet enables the 3000-kw units to be worked at the good speed of 225 r. p. m. Aside from this the generating units are of the usual design and voltage, nearly all the power being distributed at high voltage from the transformers. The circuits for the longer transmissions are to be for 44,000 volts.

Of these circuits, those now being erected are on 35-foot wooden poles, the wires being spaced 6 ft. apart. A lightning conductor is carried above the pole tops on galvanized iron pipe. The conductor is solid iron wire, a construction somewhat open to question. Stranded wire would appear to give much less risk of trouble from breakage. On a portion of the circuits steel-tower construction is to be used, following in the main the twin-tower arrangement seen already on some Northern circuits. It is open to some question whether on a system employing trunk lines in duplicate the twin construction is wise. It is novel and attractive in appearance, but open to the objection that the same cause may put both lines out of service simultaneously, the very thing which duplicate circuits are designed to avoid. On a ring system into which this may eventually grow such an accident is less serious than elsewhere, yet if it is worth while using duplicate circuits at all, it would seem generally better to use independent pole lines far enough apart to prevent the same falling limb or the same lightning stroke from putting both out of service together. The span adopted for the tower lines is conservative, being about 420 feet. The eco-

nomics of steel tower lines have not been thoroughly worked out as yet, so as to determine the best length of span. It would seem, however, that the extreme spacing sometimes tried would have small advantage unless in the employment of voltages so high that the lessened number of insulators might constitute a very material gain.

The details of the Great Falls power house seem to have been very carefully worked out. One of its most interesting features is the great attention paid to the security of the transformers against fire risk. Although transformer oil is inflammable only with difficulty, several disastrous fires have shown that it is not a risk that can safely be neglected. The transformers are of 2000-kw capacity and are arranged on trucks on the excellent compartment system. This arrangement greatly simplifies the matter of high tension wiring since it obviates the necessity of a crane in the way of the outgoing leads. The transformer tanks are closed in with relief pipes discharging outside the building, while the oil itself can be readily run off into the tail race. The unusual feature added as an extra precaution is a carbon dioxide fire extinguishing system by which the gas under pressure can be turned into any transformer case at a moment's notice. This should certainly prove effective if promptly used. There has been much discussion regarding the oil transformer as a fire risk and various plans for securing safety have been suggested. Isolation and carbon dioxide extinguisher service are precautions easily taken, and while a transformer well isolated may do no harm to others if it burns out, it is itself of sufficient value to render means of extinguishing a fire starting in the coils of considerable importance merely as insurance. The transformers in this case are water-cooled and give at full load the exceptionally high efficiency of 98.4 per cent. When the upper and lower falls of the Catawba are also developed, all three plants will be worked regularly in multiple, constituting the main group of the Southern Power Company which seems likely to cover the states pretty thoroughly with the high-tension net-work of which this is the beginning, and speaks well for the industrial future of South Carolina.

Economical Conductor Section.

Ever since Lord Kelvin enunciated his well known rule concerning the most economical cross-section of conductor to be used in a given case of electric power transmission, electrical engineers have discussed it from many standpoints, some with adulation, more with criticism, and most with diffident non-adhesion, so far as concerns practical applications. Nevertheless, the rule stands, and will no doubt continue to stand, as a rigid and unassailable law of logic and mathematics, within its own definite limits. Every one who examines the rule carefully must admit its accuracy, at least as a theoretical proposition. The range of difference in opinion must be confined to the numerous deviations that necessarily occur in practical problems from the academic assumptions contained in the rule. Many other considerations affect the engineer's choice of the sizes of conductors used in electric transmission and distribution systems. Such other considerations are the regulation of the system, its expected rapidity of growth, the possibility of securing a city permit to open trenches in streets, the cost of ducts and conduits, the safe carrying capacity of the conductors, the possibility of building new stations or sub-stations, the cost of insulators or insulating substances, and the like. Prof. Frank G. Baum contributes an article on the subject in this number, and shows that in the case of overhead wires under ordinary conditions of high-voltage transmission, the deviating influences of regulation, carrying capacity and pole-line construction are commonly subsidiary to the consideration of economy in transmission, so that Kelvin's law may occupy the first place, especially when, as in recent years, the cost of copper has risen so markedly that occasionally an excitable stockholder in a hydro-electric power-transmission plant, when the water has been low, has shouted for the sale of the appreciated copper in the transmission lines, and for going out of business on the possible proceeds.

The article shows that when the pole-line is up for a transmission system, and the choice of the exact size of wire depends only upon the greatest economy of operation with a known load, the specific cross-section of the conductor in circular-mils per ampere, when plotted against the annual cost of producing power, follows some parabola. The particular parabola is determined by the cost of copper in place, exclusive of the labor of erecting it, unless the cost of erection increases substantially as the cross-section of the wire. The article moreover adopts the cost of a kilowatt-year in the computation, as the cost of producing the same at the generating switchboard, and not the cost to the consumer. This is no doubt correct in nearly all practical cases, because if the line copper is doubled and the annual energy wasted in the line is thereby halved, there is no likelihood of selling all the extra energy saved. Thus in the very clear example offered by the paper, if doubling the size of wire enabled the sales manager to close an extra contract for five kilowatt delivery, the saving in line power waste, and so to secure $1,200 annually for the company, it would certainly pay to increase the interest cost of copper by $500 in order to do this. In practice, however, no such close sale of energy can be reckoned upon, and consequently it is the cost of producing and not the selling price of the energy which should be taken into the computation, as stated in the article. If, however, the load were quite steady, with a load factor of substantially 100 per cent, and the power generated were equally steady all the year round, so that every kilowatt saved in the line copper could be sold at the usual contract price, then, under these theoretical conditions, the formula should use the final selling price including costs of distribution, and not the price of producing power in bulk.

The real value of the Kelvin rule to the electrical engineer does not lie in determining just where the minimum theoretical expense of working a conductor may lie, but rather in ascertaining what relative economy can be effected by expending money on conductor. The article shows that the curve of total cost is an oblique hyperbola, obtained by summing corresponding ordinates of a straight ascending line of interest on copper and of a descending rectangular hyperbola of cost of energy wasted. The resulting total cost hyperbola may be very flat near its minimum, so that there will be very little theoretical change in running expense for a considerable change in line copper. Consequently, not merely the minimum, but the shape of the curve near the minimum, should be studied by the engineer in each case with the remainder of the local conditions in mind.

Indiana Telephone Convention.

The second annual convention of the Indiana Independent Telephone association, held at the Claypool Hotel, Indianapolis, May 15-16, was largely attended and was distinguished by much speech making. The members were welcomed to the city by Mayor Bookwalter. The annual address of President Lindemuth stated that no deflection into the ranks of the Bell worth mentioning had occurred. On the other hand, numerous companies having had a taste of the Bell sub-license experience, had cut loose and returned to the strictly independent relationship. Twenty-seven additional companies had joined the State Association during the year, and the number of independent telephones in use in the State was 182,000, as against 45,000 operated by the Bell interests.

Secretary Norton's report showed that the association was in a most prosperous condition; that every demand had been promptly met, still leaving a good balance in the treasury. The secretary's report showed that there had been no withdrawals during the year but the membership had increased more than 25 per cent.

President J. B. Hoge, of the National Association, addressed the convention relative to independent conditions in the several states. After congratulating Indiana upon its large convention he said the independent issue had become national. The telephone has become one of the most important utilities in the country and thirty-five million people are now using independent telephones. He said that the state conventions were well attended, and the interest manifested was very perceptible as compared with a year ago. The independent companies had been placed on a substantial basis and were giving good service at remunerative rates. He spoke of the franchises being granted to the independents to enter Milwaukee, Omaha, Denver and Chicago, and said encouraging reports were coming from Cincinnati, Boston and New York. Mr. Hoge predicted that the Chicago convention would be a record breaker and urged the independents to stand shoulder to shoulder in the good work.

The reports from the vice-presidents were very interesting and encouraging. Large gains were shown in every district, and the improvements made and being made astonished the members. Each report concluded with a comparative statement of the number of independent telephones and the number of Bell telephones in use in the district. The independents number about 5 to 1 on this showing.

Mr. Frank L. Beam, president of the Ohio Independent Telephone Association, addressed the convention briefly and urged the Indiana independents to remain loyal to the cause. He said Ohio was concerned relative to the results of this convention and asserted that reports sent out to the effect that large numbers of companies in Ohio were going over to the Bell was untrue.

Mr. Theodore Gary, of Macon, Mo., made a brief talk on the "Magnitude of the Independent Telephone Business."

Mr. C. L. Fisher, of Grand Rapids, Mich., president of the Michigan Association, made a brief talk and said conditions were very encouraging in his state. He said Indiana and Michigan were very near neighbors and mutually concerned in the independent telephone business. He urged the immediate construction of long-distance lines, saying that more independent long-distance lines was the key to the situation.

The banquet given at the Claypool on Wednesday evening by the Indianapolis Telephone Company and the New Long-Distance Telephone Company was an enjoyable occasion to the 300 members and guests. Mr. Thos. E. Davidson, of Greensburg, acted as toastmaster.

The closing session of the convention was given up to a thorough discussion of the alleged proposition of the Bell Company to enter into an agreement to surrender local exchanges in certain localities in exchange for the toll line business of the independent companies. The executive committee reported that the proposition had not been made officially and therefore there was nothing before the convention. The unanimous vote showed that the sentiment is strongly against any coalition with the Bell Company in Indiana.

The constitution and by-laws were amended so as to make any company connected up with the Bell ineligible to membership or to retain its membership after having made such connection.

The report of the tellers showed the election of the following officers: President, A. C. Lindemuth, Richmond, and C. S. Norton, of Indianapolis, secretary-treasurer. The following delegates were elected to attend the International Convention in Chicago, June 4, 5 and 6: Thos. E. Davidson, Greensburg; F. S. Shoemaker, Bloomington; A. J. Payton, Rockport; C. S. Norton, George C. Hitt, Indianapolis; F. O. Cuppy, Lafayette; Theodore Thorwood, South Bend; F. W. Shirmeyer, Decatur; Jesse Weik, Green Castle, and Jas. P. Goodrich, Winchester.

An Electric Plow Plant a Failure.

The Evansville Electric Plow & Traction Company has sold the electric light plant at Owensville, Ind., to Owensville capitalists. The plant was built originally for the purpose of testing an electric plow invented by C. H. Roberts, who was backed by a party of Evansville capitalists. The plant was constructed and equipped at a cost of several thousand dollars. The plow proved a failure and the plant was converted into a lighting power-house, from which the town has been receiving good light ever since.

When the electric plow plant project was in its infancy, farmers from all over the country went to see the machine. Some people in Europe became interested and desired to have the plow demonstrated on their farms.

The plow consisted of a large four-wheel truck to which were attached a motor and plow gangs; and received power through a steel cable, with a return wire connection.

Chicago Meeting of Illuminating Engineering Society for May.

The Chicago section of the Illuminating Engineering Society met at the Association Restaurant May 9. Mr. George C. Keech, chairman of the Chicago section, presented a paper on "Industrial Plant Illumination." This paper gave the results of eight sets of tests conducted in five different rooms. The tests were made with a Weber type of illuminometer, which was briefly described. These tests summarized were as follows:

A wood-working shop of 7044 sq. ft. area and ceilings 10 ft. 10 in. high, was tested with three different kinds of illumination, the illumination being measured at 26 test stations on a plane 3 ft. 4 ins. above the floor. With mercury-vapor lamps 9 ft. 10 ins. from the floor, the foot-candles per watt per square foot were 6.66. With clusters of Gem incandescent lamps under flat 15-in. porcelain reflectors hung 7 ft. 10 ins. from the floor the foot-candles per watt per square foot were 3.14. With 3-ampere 110-volt enclosed arc lamps hung 8 ft. 5 ins. from the floor the foot-candles per watt per square foot were 3.04. It was explained, however, in the discussion which followed the paper that the graphitized filament incandescent lamps, which were burned two in a series on 220 volts, had a very short life, which would seem to indicate that some of them were burning at considerably more than rated efficiency, due in part to unequal rating of the two lamps in a series.

In the linotype room of the Chicago *Tribune*, having 4095 sq. ft. and ceilings 14 ft. 10 ins. high, 3.5-ampere arc lamps hung 10 ft. high gave an average of 2.65 foot-candles per watt per square foot. Mercury-vapor lamps in the same room hung 13 ft. high gave 5.99 average foot-candles per watt per square foot.

In a machine shop having 2647 sq. ft. area, with 11 ft. 6 in. ceilings, mercury-vapor lamps hung 8 ft. 8 ins. from the floor gave an average foot-candles per watt per square foot of 6.12.

In a machine shop of similar size, having 2744 sq. ft. and 14 ft. 8 ins. ceilings, 5-ampere enclosed arc lamps gave 1.66 foot-candles per watt per square foot.

In the drafting room of the North Works of the Illinois Steel Company, Chicago, mercury-vapor lamps were arranged

above each window to give the light as nearly the same direction as daylight as possible. This room had 3914 sq. ft. and gave 4.92 foot-candles per watt per square foot.

During the reading of the paper, the author called attention to the fact that this was the first paper giving illuminating results presented before the society in which the efficiency of illumination had been expressed in average foot-candles per watt per square foot, although Mr. Cravath, in the discussion at the March meeting had compared a number of the tests previously presented to the society on this basis. The papers previously presented had not given results in any unit by which comparison of one installation with another could be made. The average foot-candles divided by the watts per square foot gave a convenient unit of this kind, and he thought it would be well to fix upon some short, less clumsy name for the unit than foot-candles per watt per square foot.

In the discussion Mr. O. C. Spurling objected to a light entirely without shadows. He also said that it was necessary to have an individual lamp at each piece of running machinery on account of the accident liability and the effect that the absence of such a lamp might have on accident claims. Mr. Albert Scheible thought the individual lamp unnecessary if an effect approaching daylight was produced. Mr. J. R. Cravath thought it a fallacy that shadows were necessary to clearly distinguish objects, because there are practically no shadows out-doors on a cloudy day, yet there is no difficulty in distinguishing objects clearly.

Mr. S. M. Bushnell called attention to the fact that in a factory-regulation law recently presented at the Illinois Legislature one clause provided that no clear bulb incandescent lamps should be exposed in a factory. While this clause had been struck out, he believed it showed the general trend toward softer effects in lighting which would be easier on the eye. He commended the softness of the mercury-vapor lamp.

Mr. N. R. Stansel gave the life results on 20 mercury-vapor lamps running 24 hours per day in the Chicago post-office. Fifteen of these tubes had run 7000 hours to date. Five had broken or burned out. The lamps were hung only 8 ft. 2 ins. from the floor in this particular case, so that breakages amounted to more than burn-outs. These tubes apparently got brittle after many hours' use, so that if they were moved from one place to another after being in use some time, great care was necessary.

Mr. Cravath clasisfied industrial plant lighting under three heads: 1. That by individual incandescent or gas lamps for each workman. 2. General lighting where the space is so flooded with light that individual lamps are not necessary. 3. A combination of the two methods. A system of lighting entirely by individual lamps was not entirely good, even when the individual lamps were properly shaded with efficient reflectors, because a light from one point only caused too much glisten and glare by reflection from tools and work. Such a system is cheap to operate, but not cheap when the results obtained from the workmen under such circumstances were figured. The tendency was more and more toward providing general lighting sufficient to obviate the necessity for individual lamps, but there are still many places where individual lamps will probably always be necessary

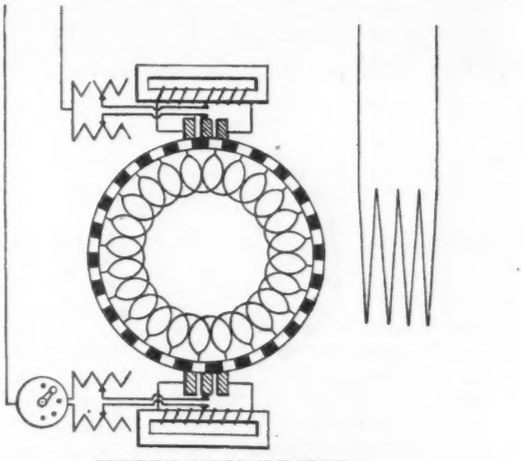
Mr. Stansel said that in wood-working shops and steel plate shops general lighting without individual lamps was usually satisfactory. In furniture shops and erecting shops individual lamps were necessary, as lamps had to be put in places where no general system of illumination could reach. He condemned the use of a few isolated arc lamps where no other system of illumination was generally used, as such lamps were likely to be out much of the time on account of the lack of trimming and care.

Lead-Eating Grubs in Chicago Stockyards.

Previous items have appeared in these columns as to grubs which have been attacking lead-covered wires in the plant of the S. & S. Packing Company at the Chicago stockyards. These grubs appear to be found only in the vicinity of decaying animal matter, and in this case in the houses used for the storage of hoofs. The lead-covered wires attacked were those belonging to a watchman time circuit, which is cleated directly to wooden partitions. To learn if these grubs attack cable when it is in the open, or whether in burrowing through wood as is their usual custom they come to the lead covering of a cable and continue to go on burrowing, a representative of the ELECTRICAL WORLD called on Mr. J. Morgan, electrician foreman of the S. & S. Packing Company and with him made a visit to the scene of the trouble. It was found that cable had been attacked in both of the ways mentioned. In some cases the insects came up through the wood into the lead covering, where the cable was fastened down tightly to the wood by cleats. In other cases they attacked the lead cable in the open where it was not in contact with the wood. After getting into the cable they burrow around in the insulation, just as they would in any other material in which they are accustomed to burrow. As stated in a previous item, no trouble is anticipated from these insects except in places where there is decaying animal matter. Electric light and power wires in the same packing house have not been troubled because they are supported on insulators in the usual way and small defects in the insulating covering make very little difference. Anyone particularly interested in the subject of lead-burrowing insects will find it well-treated in a paper presented before the St. Louis International Electrical Congress, where an account is given of trouble experienced in Australia and China.

Prevention of Sparking in Single-Phase Motors.

A modification of the resistance-lead method of preventing sparking in alternating-current commutator motors is disclosed in a patent issued April 30 to A. S. McAllister. Instead of placing the resistances between the armature coils and the commutator bars, where the space is limited, they are placed external to the armature, and the internal transformer voltage generated in the armature circuit by the field flux is transferred to the external circuit by means of a stationary auto-transformer. For this purpose the commutator is arranged with alternate live and dead segments, as shown in the accompanying illustration, and at each point of commutation there are used three independently insulated brushes, the two outer brushes being connected to the terminals of the auto-trans-



EXTERNAL RESISTANCE LEADS.

former. The preventive resistances are placed in the supply leads, being inserted between the neutral point of the auto-transformer and the third brush. It is claimed that the resistances can be made of ample current carrying capacity for the maximum load of the machine and are, therefore, not subject to burn-outs, and that the amount of resistance in circuit can readily be varied during operation.

Electric Refrigeration at Thompson's Spa, Boston.

In the Electrical World for May 11 was published an account of the electric refrigerating plant at Thompson's Spa,

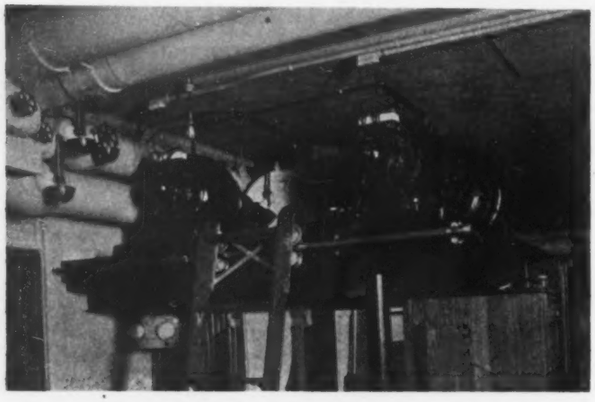


FIG. 1.—BRINE PUMPS.

Boston, Mass. Through an oversight the illustrations used were those belonging to another article, they having been accidentally substituted for the proper ones in the make-

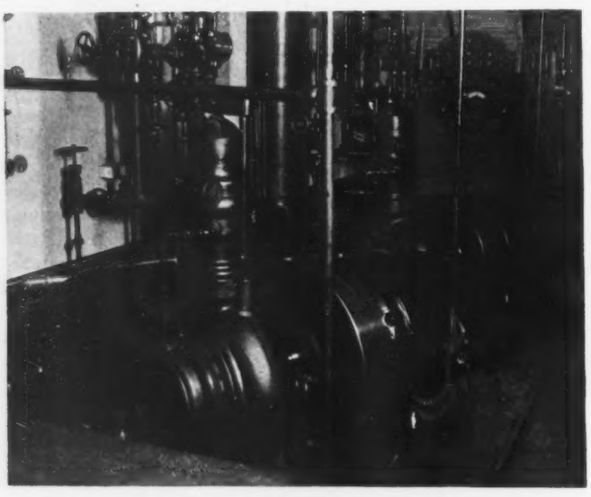


FIG. 2.—MOTOR-DRIVEN COMPRESSORS.

up of the form. The accompanying illustrations are the ones that should have been used, Fig. 1 representing the brine pumps and Fig. 2 the motor-driven compressors.

Methods of Electric Lighting for Railway Trains.

Prof. Dugald C. Jackson presented a paper on "Methods of Electric Lighting for Railway Trains" before the Western Society of Engineers at Chicago, May 15. This paper contains a summary of the results and a portion of the data obtained in a series of tests and examinations of the different apparatus used in the electric lighting of Western railway trains, made under his supervision during the past two years while still connected with the University of Wisconsin. The greater part of the work was carried out under the direction of Mr. Edward Wray. The systems investigated were: 1. Those in which a steam-driven generator set is located in the baggage car. 2. Those in which the generator is located under each car and driven by the car axle. 3. Those in which a storage battery is located in each car, which is charged at the end of the run. A 25-kw direct-current Curtis turbine was tested in the laboratory under conditions corresponding to conditions of service as determined by a test run made on the Burlington route between Chicago and Denver. When this turbine was running on a steady load of about 15-kw, as it would during the evening, its steam consumption was about 90 lbs. per kw-hour. As the load fell off to about 5 kw as during the night, the steam consumption went up to 160 lbs. per kw-hour, the steam pressure in both cases being approximately 80 lbs. per sq. in., supplied through a reducing valve from the locomotive. A similar type of turbine tested at the laboratory with a load of 20 kw took 80 lbs. of steam per kw-hour. While the steam-consumption is thus much higher than for reciprocating engines under similar conditions, Prof. Jackson considered that the other advantages of the turbines, including that of the freedom from vibration, are doubtless sufficient to counterbalance this. For the total run between Chicago and Denver the steam consumption is approximately 3 per cent of the total water supplied to the locomotive boiler. A 25-kw generator driven by a Westinghouse standard engine showed a steam consumption of 75 lbs. of steam per kw-hour at 16 kw load with 83 lbs. of steam pressure and 115 lbs. per kw-hour at 5 kw load. A considerable portion of the paper is given to tests on several axle systems of lighting, showing the amount of charge and discharge of the batteries, etc. The efficiency of the batteries under railroad conditions are shown to be from 45 to 50 per cent.

In the discussion of the paper Mr. Bowen, of the Northern Pacific Railway, said it was an advantage of the axle-lighting system that when the speed fell below that at which the generator was cut in, as it would on heavy up-grades, there was not so much drain on the locomotive; while with an engine or turbine running continuously the drain was equal on both up and down grades. Furthermore, when the train was drifting with steam shut off the axle-lighting system was drawing nothing from the locomotive, whereas with a steam generating unit there is a constant drain. It is also undesirable to pipe steam from the locomotive back one or two cars.

Mr. J. R. Cravath said that after spending so much money and trouble to get an electric train-lighting system, it was worth while to pay more attention to how the light was utilized after it was secured. Most electric train lighting is done without any regard to simple, common-sense illuminating engineering principles, which, if applied, would produce as good results as far as passengers are concerned as are now being produced, and that with but half the present amount of electrical energy.

Electric Trunk Line Operation.

A paper read on May 21 before the American Institute of Electrical Engineers by Mr. Frank J. Sprague, discussed in great detail the essential characteristics of direct-current and alternating-current equipments as affecting the operation of trunk lines electrically. It was shown that the ratio of the impedance of certain 80-lb. steel rails at 25 cycles was found to be 9 times the resistance for direct current. In comparing the third-rail with the overhead trolley it was stated that the third rail is an inert structure, is not under strain and its expansion can readily be taken care of. The overhead trolley, however, is under strain and as ordinarily constructed is subject to extreme variation of tension on account of weather conditions.

Data were given on a certain 125-hp, single-phase, 25-cycle motor and a 240-hp, 550-volt, direct-current motor having approximately equal weights, from which the author concluded that a pair of the alternating-current motors can handle only about one-half of the total load of the direct-current motors. Although a 15-cycle motor has certain distinct advantages over a 25-cycle motor, the total weight of apparatus on a car for a given capacity is approximately the same within a very wide range of frequency.

During the last two years important developments have taken place in direct-current motor construction which materially change any preconceived conclusions as to its limita-

tions. The first is the introduction of the commutating pole, which has practically eliminated commutator troubles. That this improvement has reached a high degree of commercial standing, despite very recent technical criticism and opposition, is evidenced by the fact that orders for nearly a thousand railway motors have been placed within the last two months. This improvement makes possible the shunted-field addition to the series-paralell control of speed, the construction of motors for operation at much higher potentials, and the operation of two motors in series at double potential.

The author stated that the present principal hope of usefulness of the single-phase system is on roads of considerable extent which operate an irregular and sparce traffic, and where only a moderately expensive, or what may be called a second-class overhead construction which will keep down the ratio of line investment to that of the balance of equipment, is tolerable. As one departs from this condition, adopts more permanent construction, and faces the problems of denser traffics and higher capacities, any advantages of the single-phase system will disappear, and a superiority of the direct-current equipment, with such improvements as are in sight, become manifest. "But whatever may be the future of single-phase operation under the conditions stated, any present claim for it as the preferable equipment for congested service demanding high schedules and great capacity is not worth a moment's thought, for in this field, at least, it cannot touch the direct-current system."

The discussion was opened by Mr. W. J. Wilgus, who expressed the opinion that the progress in connection with the general electrification of steam roads will be much advanced if the electrical engineers and the railway engineers will co-operate in their endeavors. The principal advantage of the electric motor over the steam locomotive for passenger work resides in the increased business which can be accomplished when the tracks are limited. An actual increase of at least 30 per cent has been found in the case of the terminal electrification of the New York Central Railroad.

Mr. L. B. Stillwell stated that incorrect conclusions might be drawn from the fact that the impedance drop in rails for alternating current is greater than the resistance drop in the same rails for the same value of direct current. When alternating current is used the percentage drop is very much lower and even the actual drop is considerably lower than is true with direct current. Thus in a certain recent installation the percentage loss with alternating current was observed to be about one-fortieth of the loss which would have been found with direct current.

Mr. W. B. Potter remarked that the large manufacturing companies do not favor one system over another from a prejudiced point of view. As a matter of fact, the General Electric Company at the present time is building numerous 600-volt and 1200-volt direct-current equipments, and both single-phase and three-phase alternating-current equipments. The introduction of commutating poles in direct-current railway motors has resulted in the elimination of all sparking and the motors have been enormously improved. He announced that equally as great improvements have recently been made in single-phase commutator motors. A new design of such motors has allowed the weight to be much increased, the efficiency to be improved and the commutation to be rendered practically perfect.

Mr. C. F. Scott criticised a comparison which had been made with reference to the performance characteristics of single-phase and direct-current motors. It is possible by means of transformers to adjust the terminal voltage on an alternating-current motor to any value desired, so that any torque can be obtained at any speed, while such is not true of the direct-current machine. He announced that practical experiments have shown that alternating-current, single-phase series motors can conveniently be arranged for electric breaking and for electric recuperation. Operation of such motors under the above conditions will be described at the annual meeting of the A. I. E. E.

Mr. M. W. Storer compared the performance characteristics of a 90-hp, direct-current motor with a 25-cycle, 100-hp, single-phase motor, and a direct-current, 200-hp motor with a 15-cycle, 200-hp, single-phase motor. At torques varying from 25 per cent to 125 per cent of the full load value, the efficiency of the alternating-current machine was found to be between .5 per cent and 4.0 per cent less than that of the corresponding direct-current machine. A direct-current motor can certainly be built to commutate satisfactorily on 1200 volts. Such a motor will probably be designed with the same style of compensating winding on the field as is now used for single-phase motors. It will possess the disadvantage of a high voltage always present on the windings and the brush-holders. If it were not for the greater possibilities of the single-phase system there is no question but that the high-voltage direct-current motor would be quite attractive. He expressed the opinion, however, that the single-phase system with its much higher line voltage and much lower motor voltage offers a better solution for the entire railway problem.

Mr. G. R. Henderson called attention to the great importance of the space-load factor and the time-load factor on railway systems. In certain sections of the West where trains are operated with great frequency and under heavy loads at certain times of the year, and where at other times of the year very few trains are running, it would certainly not be advantageous to electrify the roads; but where the traffic is dense and the load is relatively constant electrification is advantageous. On account of the high efficiency of steam locomotives it is not to be expected that the electric system will show better fuel economy. It would be extremely advantageous for all parties concerned if the railway men and the electrical engineers would discuss the electrification problem frankly and in non-technical terms without too great stress being laid upon minor details and personal prejudices.

Mr. William McClellan expressed his regret that as yet no data have been published on the performance of 1200-volt direct-current motors. There is no doubt, however, that the alternating-current motors operate on the multiple-unit system at 11,000 volts with entire satisfaction, and that any belief to the contrary is due to a lack of knowledge of facts.

Mr. A. H. Armstrong stated that he had recently observed a 125-hp single-phase motor operating at 50 per cent over-load without any sign whatsoever of sparking. Thus the possibilities of the single-phase motor have not been exhausted and many interesting developments may be looked for.

Dr. C. P. Steinmetz stated that it would be disadvantageous at the present time to adopt any standards which would limit future developments. A frequency of 25 cycles has proven satisfactory for general power transmission purposes, and it does not seem desirable to adopt a lower frequency. Single-phase commutator motors can operate economically and without any difficulties at this frequency, and the slight improvement in performance on 15 cycles, which is found with certain types of motors, is not sufficient to justify the adoption of this frequency when other types of machines show better performance at 25 cycles.

Telephony in Ohio.

Much discussion has been occasioned by newspaper reports to the effect that an arrangement has been completed by which the Bell interests would secure all the long-distance business in Ohio and Indiana, while the independents would confine their operations to local exchanges. From what information can be secured, it would seem that a partial understanding exists between the contending interests, that the Bell lines may take any business from small exchanges that cannot be handled over the independent long-distance lines. Further than this, it seems that there has been no negotiation. The independents do not give up anything, but merely feel that such action is to the interest of their patrons, where they can be supplied with long-distance service in no other way. That the Bell interests have taken over the independent plant at Marion, has been vehemently denied by both Mr. J. B. Hoge, president of the National Independent Telephone Association, and Mr. Frank L. Beam, president and manager of the Ohio Independent Telephone Association.

CURRENT NEWS AND NOTES.

REGULATION IN CHICAGO.—A bill has been passed by the Illinois legislature fixing the price of electricity in the city of Chicago at seven cents per kw-hour, and requiring the electric light companies to use meters that can easily be read by the customers of such companies.

A. I. E. E. IN TOLEDO.—At a meeting in the Smith & Baker building one evening last week, the electrical engineers of Toledo decided to apply for authority to establish a branch of the American Institute of Electrical Engineers there. For some time a movement has been on foot to form an organization of this kind, although it had not been decided whether an independent organization would be formed or not. Mr. W. G. Nagel was elected chairman of the temporary organization and Mr. George E. Kirk secretary.

THE MOORE TUBES.—We understand from Mr. D. McFarlan Moore that our editorial comments of May 4 on his recent Institute paper and tests are regarded by him as a reflection on his honesty and personal or professional integrity. As the general tenor of the comments was kindly and warmly laudatory we are surprised, and must refer our readers to the article for confirmation of our statement as to good and helpful intent. Mr. Moore's uphill work has always been worthy of praise and he has added to the resources of the art. While we are unable to change our point of view, however, and while we submit that our comments are fair and legitimate, we hasten to withdraw any expression that in any way wounds Mr. Moore's feelings or seems to cast any kind of suspicion or doubt on his assertions. We hope to see Mr. Moore make notable improvements and advances along the line of investigation he has marked out so distinctly for himself in a difficult field of endeavor.

PREMIUMS AND CUSTOMERS.—Last December the Commonwealth Electric Company and Chicago Edison Company came out with a premium offer to boys who would secure new customers. These premiums consisted principally of electrical toys. For one new customer, a premium consisting of one toy electric motor was given. For two new customers, this motor together with a line of counter shafting was given. For three new customers, a larger size of motor was offered; and for four, a third-rail miniature electric car. This offer was advertised extensively in the official "Electric City" magazine, which is the bulletin of the companies. Besides this, there were four offers for securing the sale of electric cooking or heating apparatus to existing customers. The purchase of an electric flatiron or anything of equal value entitled the boy bringing in the order to the toy mentioned in the first offer. For the purchase of apparatus of over $10 in value, the same premium as for two customers was given, for apparatus of $15 value the same premium as for three customers, and for apparatus of $25 value the same premium as for four customers. This scheme resulted in bringing in about 300 new customers.

A. I. E. E. ELECTION.—The annual meeting of the American Institute of Electrical Engineers was held in the Engineering Societies Building on May 21, with an attendance of several hundred members. The new constitution was declared to have been adopted by vote and will be effective in 20 days. The report of the directors showed a total of 4521 members on April 30, 1907, the number of new associates elected during the year being 751. Two hundred branch meetings had been held with a total attendance of 16,500, and with 137 original papers. The building fund committee reported subscriptions in all of $163,734 from 934 members and friends, and cash collections to April 30 of $124,819. Note was made of the occupancy of the new building, and the balance sheet showed its inclusion as an asset in which the institute has an equity of $350,000, out of a total property account of $408,467, to which should be added $18,124 cash in hand. The balance sheet for the year showed an income of $55,184, and disbursements of $52,538, leaving an excess receipts of $2,645. The collections for the separate building fund account during the year, including interest, were $37,062. The election of officers for the year 1907-8 resulted as follows: Mr. H. G. Stott, president, with 1312 votes; vice-presidents for two years, Messrs. L. A. Ferguson, J. G. White and W. C. L. Eglin; managers for three years, Messrs. B. G. Lamme, H. W. Buck, P. H. Thomas and Prof. Morgan Brooks; secretary, Mr. Ralph W. Pope; treasurer, Mr. George A. Hamilton.

EXHIBITS AT WASHINGTON.—There is every prospect that a large and interesting exhibit of apparatus will be made at the Washington convention of the National Electric Light Association the first week in June. At the present moment the list includes the following: Standard Vitrified Conduit Company, Franklin Electric Mfg. Company, Pettingill-Andrews Company, Philadelphia Electric & Mfg. Company, Southern Exchange Company, John L. Gleason, C. W. Lee Company, Federal Electric Company, Crocker-Wheeler Company, Fibre Conduit Company, American Electric Heater Company, Dearborn Drug & Chemical Company, M. O. Publishing Bureau, Electric Storage Battery Company, H. W. Johns Manville Company, *Electrical Review,* Oneida Community, Ltd., American Instrument Company, N. Y. Beck Lamp Company, Fort Wayne Electric Works, Weston Electrical Instrument Company, Curtis Advertising Company, National Electric Lamp Association, Western Electric Company, Simplex Electric Heating Company, General Electric Company, Pope Motor Car Company, Westinghouse Companies, Crouse-Hinds Company, Jandus Electric Company, Electrical World, Allis-Chalmers Company, Wagner Electric Mfg. Company, Harold P. Brown, Standard Paint Company, Metropolitan Engineering Company, Dossert & Company, W. J. Barr Electric Company. A number of others are now negotiating for space. A special uniform style of booth has been adopted. The exhibit committee is spending about $1,500 in electrical decorations for the large ballroom of the new Willard Hotel where the display will be made.

GROWTH IN FORMOSA.—U. S. Consul Arnold, of Tamsui, makes note of recent developments in Formosa. The lower house of the Japanese Diet has sanctioned a loan of $950,000 gold to the Formosan government, to be paid in two annual installments, beginning with the fiscal year, March, 1907, for the installation of a plant for supplying 3,000,000 gallons of water daily to the city of Taihoku. The water is to be pumped from the river into a settling tank, thence over a series of two filter beds; a second pump will force it into a double compartment reservoir upon a hill 100 feet directly above. These pumps are to be operated by electric power, to be furnished by a generating plant a few miles away. There is at present a 660-hp electric generating plant at Kushagu, which transmits its power a distance of 15 miles to Taihoku. This plant is inadequate for present demands. There is now before the Japanese Diet a resolution providing for a loan of $750,000 gold to the Formosan government for the purpose of installing an electric-generating plant at Keibei, five miles distant from Taihoku City, It is proposed to run a ditch from Shin Tiem, on the headwaters of the Tamsui River to Keibei, a distance of two miles. At Keibei there is to be erected a powerhouse for the generation of 2000 hp of electricity, for transmission to Taihoku. The specifications will call for five 500-hp alternating current generators and for turbines, transformers, conductors, and other equipments. The present plant is equipped with American made machinery throughout. It is proposed to utilize the power generated by this new plant for operating the pumps in connection with the waterworks mentioned as well as to supply light and power to Taihoku City. It is quite possible that in the event of the consummation of the scheme for a system of trolleys at Taihoku, electrical energy will be furnished from this plant.

TELEGRAPH EXPERTS COMING.—A dispatch from Berlin, of May 18, says that the German Government has sent to the United States several officials in its telegraph service, who will study and report upon the organization of telegraph and telephone companies in America.

MISSOURI ANTI-TRUST LAW.—Advices from St. Louis of May 18, state that an ouster suit has been filed in the Circuit Court by Circuit Attorney Sager against the Laclede Gas Light Company and the Union Electric Light & Power Company. The companies are charged with violation of the anti-trust laws of Missouri, it being alleged that they have formed a combination giving them a monopoly on the lighting utilities of St. Louis.

EDITORS TO TRAVEL.—The following dispatch, which is not very illuminating, has been received from Rome under date of May 18: "D. Sidney Appleton, the publisher of London and New York, is now in Rome making arrangements with the Italian Government to have a number of American and British editors visit Italy next September to study the economic and industrial conditions of the country, with a view to the investment of American and British capital, particularly in the improvement of the railroads, the development of manufactures, and the extension of the street railroad systems."

WIRELESS AND LAWLESS.—According to advices from Washington, the apparent condition that there is no law giving authority to government officers to protect official wireless stations in the exchange of messages is giving a great deal of trouble to the station at the Washington navy yard. A youth living near by, the son of a policeman, has set up a station of his own, and takes delight in interpolating messages during official exchanges. He has represented himself to be at distant naval stations or at sea on warships equipped with wireless apparatus. The local police authorities were appealed to, but said they had no power to interfere with the young man's experiments. A possible remedy, justified by the political situation, would be to declare a state of war to be existing in the vicinity of the White House.

ATROPHIED ACADEMICIANS.—It is stated from Paris that the Mazarin Palace, home of the French Academy, which represents the nation's greatest achievements in science, literature and art, was long without a telephone, and when finally a telephone was reluctantly admitted it still had three implacable enemies, M. Berthelot, the illustrious chemist, who died recently; M. Gaston Boissier, life secretary of the French Academy, and M. Georges de Porto Riche, administrator of the palace and a playwright of high reputation. M. Boissier and M. Riche refuse to have a telephone at their private residences. The latter says: "I don't know how to use the telephone." The academicians have charge of the French dictionary and are the watchdogs of the purity of French speech, so that this prejudice against an appliance which makes for linguistic intercourse is more than usually puzzling and inexplicable.

A MUSEUM OF VOICES.—At Washington a movement is on foot to install at the Congressional Library a department of phonographic records containing the utterances of statesmen and other distinguished men from all parts of the world. The idea started with the gift of a phonographic record of an address delivered by Kaiser Wilhelm. An attempt will be made to have the leading men of the country talk into the phonograph, and records thus made will be sent to the library. The Smithsonian Institution has some most interesting records of Indian dialects, and the authorities propose to follow the example of the French and Austrian governments to preserve famous voices of the stage as well as of the forum. The New York Electrical Society can contribute the record made by the late Vice-President Hobart in opening the electrical exposition given in this city under its auspices.

PITTSBURG TECHNICAL NIGHT SCHOOL.—The Casino Technical Night School, Turtle Creek, Pa., which was started in 1902, has at present 201 students. This school, which was organized to provide an educational opportunity for employees of the Westinghouse Companies, was formerly located in the Casino building at East Pittsburg, but in the fall of 1904 the school was moved to the public school building of Turtle Creek. There are a two-year preparatory course and a three-year course in practical engineering. The object of the latter course is to prepare the student "to enter the field of steam and electric installation, testing, operation of power stations, wiring, inspecting, general road work, and various assistantships." Mr. L. O. Packer is president of the school. Mr. C. R. Dooley is in charge of the electrical instruction, with three assistants.

TO HELP OXFORD.—Lord Curzon, the newly elected chancellor of Oxford University, is issuing an appeal for money to the world at large. A meeting was held in the old university city a couple of weeks ago to consider means to increase the revenues of that most ancient English institution of learning and letters. Funds are needed for the Bodleian Library, and also for an electrical laboratory and foundations for the study of engineering, hygiene and scientific agriculture. The teaching staff of the university needs more instructors in the modern languages, especially English, and French and German as well. The various colleges now contribute to the university about $200,000 yearly, and Lord Curzon points out that Oxford "cannot be re-endowed, entirely or even mainly, from within." He makes his appeal to "all who are interested in the continued well-being and usefulness of the oldest university in the empire."

WASHINGTON SPECIAL TRAIN.—For the Washington convention of the National Electric Light Association, Mr. George F. Porter, master of transportation, announces that a special train of parlor cars will leave New York via Central Railroad of New Jersey and Baltimore & Ohio Railroad, foot of West Twenty-Third Street, 8:50 a. m. (Liberty Street, 9 a. m.); Newark (Broad Street) 9:30 a. m.; Trenton Junction, 10:20 a. m.; Philadelphia (Twenty-Fourth and Chestnut Streets), 11:15 a. m.; Wilmington, 11:50 a. m.; Baltimore, 1:15 p m., on Monday, June 3, 1907, arriving at Washington, D. C., at 2 p. m. Application should be made promptly, as the reservations in hand will already fill three cars. The transportation committees all over the country of the association report a large prospective attendance. Mr. C. H. Hodgkinson, who is acting for New England, is doing excellent work to insure the comfort and convenience of a large contingent from Boston and other cities in that section.

THE PANAMA CANAL.—"The mosquito problem is the one to be solved in the building of the Panama canal, and when it is done the rest of the work will be purely a question of engineering. It was in the above respect that the French failed, for their efforts to dig the canal were started in a time when science was not far enough advanced to deal properly with the necessary matters of sanitation." The speaker was Prof. Elihu Thomson, and the remark was made in his lecture before the Schenectady Branch of the American Institute of Electrical Engineers, in the High School auditorium on May 16. The event was the last of the series of winter meetings of the institute and Prof. Thomson, who visited the canal in company with a number of business men from this country, spoke on "The Panama Canal and the West Indies." There was a record breaking attendance and the audience frequently showed its appreciation of the speaker's remarks. Prof. Thomson illustrated his talk with stereopticon views which were from snap shots he took himself when on the trip. These views were described in a manner that gave the listeners a better idea of the conditions in the canal zone than could be obtained from reading countless books on the subject.

McGILL ENGINEERING BUILDING.—The walls remaining standing of the engineering building of McGill University, recently destroyed by fire, are being taken down preparatory to the erection of another and larger building for the engineering department.

TROLLEY EMINENT DOMAIN.—The Homsher bill extending to trolley roads in Pennsylvania the right of eminent domain has been passed by the State Senate, and will, it is understood, become law. An unsuccessful attempt was made at the last minute to eliminate from the bill the provision requiring trolley companies to secure the consent of the owners of 51 per cent of the foot frontage of the entire distance to be traversed before the right of eminent domain shall be granted.

TRAINING AT INDIANAPOLIS.—The Jenny Electric Company, the Atlas Engine Works and a number of other similar concerns have turned over to the Technical School of Indianapolis so much work that hereafter the students who are learning trades in the school will receive regular wages. Every month, too, the profits which accrue will be divided among the students in proportion to the work they have done, to further increase their income. Many of the students are said to be paying all their expenses while in the school.

TELEGRAPHY IN PERU.—U. S. Consul C. C. Eberhardt writes from Iquitos that the Peruvian telegraph service being established between Lima and Iquitos has been completed as far as Masisea, a point on the Ucayali River. The system will be of wireless telegraphy, except for the distance between Lima and Puerto Bermudas. Heretofore communications between Lima and Iquitos required from twenty-five to sixty days, but this will be reduced on the completion of the telegraph service to twelve days, which includes launch service for a distance of 1000 miles.

N. E. L. A. MEMBERS.—At the May meeting of the executive committee of the National Electric Light Association, 17 local lighting companies were added to the Class A membership, while 25 individuals were added to Class B. There were 5 additions to Class D and 5 to Class E. These figures are a good indication of the healthy growth of this body and of the interest felt in its welfare and work throughout the country. The work that Mr. Crouse, chairman of the membership committee, is doing will make itself felt in new accessions of this character for a long time to come.

LIGHTING THE ETERNAL CITY.—The Bulletin of the French Chamber of Commerce at Milan states that the municipality of Rome is considering a scheme for the establishment of a municipal electric-lighting service in that city. It is proposed to raise a loan of $695,765 for this purpose. Of this sum, $19,300 would be devoted to the purchase of a site for a generating station and $373,889 to the building and equipment thereof and to laying down wires—private tenders to be invited for these works. The special appliances required for the other purposes of the work would be purchased direct by the municipality from leading manufacturers.

SPECULATION IN JAPAN.—According to advices received at Victoria, B. C., the speculative craze in Japan is being stopped, and within the past few weeks thirty projected companies have dissolved with an aggregated capital of $350,000,000. The market is expected to be further relieved by the abandonment of other concerns with an aggregated capital of $100,000,000. This has necessitated the cancelling of large orders of machinery, most of which were placed in the United States. The Japanese government has also declined to sanction the construction of no less than thirty electric railways on the ground that to grant the charters for these lines would be opposed to the government's policy of state ownership.

GOVERNMENT MONEY TRANSFERS.—Note is made of recent heavy transfers of money telegraphically through the U. S. sub-treasuries. The method of making such transfers, for example, is for a bank of New York to deposit, say, $1,000,000 with the assistant treasurer of the U. S. Sub-Treasury, and against this deposit the assistant treasurer telegraphs an order to the San Francisco sub-treasury to release to the accredited bank in that city an equal amount of money. Permission to make such telegraphic transfers has, of course, first to be obtained from Washington. The Government makes only a moderate charge for its service, not more than $3 to cover telegraph tolls. This is far less than would be the express charge upon such a sum of money to San Francisco, to say nothing of the time consumed in its transfer by railroad.

ENGLISH MUNICIPAL GRAFTERS.—A cable dispatch from London, of May 17, announces that, with a single exception, all the members of the West Ham Board of Guardians and the Workhouse and Infirmary officials whose trial began at the Central Criminal Court on April 24 on the charge of receiving bribes have been found guilty and sentenced to terms of imprisonment at hard labor, varying from six months to two years. In summing up, Justice Jelf characterized the practices disclosed in the evidence as being a curse to the country. He added that he was afraid it was a growing curse, and that the people were losing their hold on all that was best in the civic life of the country. The sums involved were comparatively small. A doctor, for instance, paid £100 for a hospital appointment. Attorney General Walton and three assistants prosecuted the officials, who were defended by a large number of counsel. West Ham is one of the typical cases of municipal ownership against which the people of London made their recent great revolt.

TELEGRAPHERS DISSATISFIED.—It is stated by Mr. Samuel J. Small, president of the Telegraphers' Union, which has been active for several months in organizing the telegraphers throughout the Union, that an ultimatum has been presented to the Western Union Telegraph Company respecting the alleged discharge of union men and a wage adjustment. The company granted a general 10 per cent increase in wages about six weeks ago. The union is known as the Commercial Telegraphers' Union of America, to which most of the 20,000 Western Union operators in the United States and Canada belong. Mr. Small says that, should the final demand of the union be refused, serious results will follow. There is no suggestion of a strike in case of refusal, but in the event of the Western Union refusing to grant the demands of the union, he says the union will "stand by its guns and will fight the matter out, no matter to what end it may lead." It would appear that the men accuse the company of bad faith in carrying out its agreement to advance wages 10 per cent when it put up the rates for messages.

TRACTION IN BUENOS AYRES.—U. S. Consul-General Alban G. Snyder reports as follows from Buenos Ayres: Much talk has been indulged in during the past few months as to the feasibility of undertaking some kind of an underground railway system in order to relieve the present congested state of traffic in the overcrowded and narrow streets of this city, which has resulted in several rumored propositions, none of which has assumed serious enough aspects to warrant much consideration. It is now stated that the new mayor has taken up this question of tubes seriously, and has called several conferences of high officials interested in the matter of transportation to study the question, and full details of such a project are to be drawn up, and when completed tenders will be solicited for the construction of same for account of the city, the constructors being allowed to work the lines for a certain number of years. I am of the opinion that there is need of such and that it would prove a profitable undertaking. I submit this report in order to advise American contractors and engineers beforehand, and if anything definite develops, a further report will be made.

Hydro-Electric Developments on the Catawba River, South Carolina.

IN our issue for July 23, 1904, there was given a description of the hydro-electric plant of the Catawba Power Company, at Indian Hook Shoals, on the Catawba River, in South Carolina. This company has been merged with the Catawba Electric & Manufacturing Company, under the name of the Southern Power Company, which now owns or controls nine water-power sites in the so-called Piedmont Section in the Carolinas. The total power available is 100,000 kilowatts.

Work is now being hurried to completion on the development at Great Falls on the Catawba River, which consist of a series of falls and shoals having a total head of 176 feet in a distance of about 8 miles. In this development there will be three separate plants, the down-stream one giving 60 ft. fall, the up-stream one 40 ft. and the middle one 72 ft. The latter plant, known as the Great Falls Station, is described in detail below.

HYDRAULIC DEVELOPMENT.

The hydraulic part of the development consists essentially of a low spillway dam at the head of Mountain Island to deflect the water into the western channel. Flowing through this channel nearly to the foot of the island, it is then forced through the headgates of the canal by another spillway dam. An extension of this dam serves as an overflow weir between the canal and the river. From this point the stream is carried by a canal through a natural valley about 1¼ miles to the power-house and a retaining bulkhead built across the valley, while below the power-house the tailrace carries off the spent waters, ¼ mile to Rocky Creek, in which channel it is again carried to the river bed.

At the lower end of the canal the water is impounded by a concrete retaining wall, in which are built the intake flumes for the turbines, and below which is located the power house which virtually forms a part of the retaining wall. An additional side of the power house is formed by the arches spanning the tailraces from the turbines; the building is 250 ft. long, and 37 ft. wide.

FIG. 1.—VIEW OF POWER HOUSE UNDER CONSTRUCTION.

TURBINES.

There are 10 turbine units each consisting of a pair of horizontal twin turbines with top inlet and center discharge; of these, eight are 3900-kw machines designed for 225 r. p. m., while two are 525-kw machines designed for 450 r. p. m. Two of the larger turbines were built by the Holyoke Machine Company, while all of the other turbines were furnished by the Allis-Chalmers Company. The intake of water to each turbine is regulated by means of a Lombard governor.

GENERATORS.

The generating equipment consists of eight 3000-kw 60-cycle, 2300-volt alternators and two 400-kw, 250-volt direct-current exciter dynamos. Each alternator is so designed that when the field circuit is supplied with 200 amperes at approximately 160 volts, it will deliver its normal output at 100 per cent power-factor, while the exciting current must be 260 amperes when the alternator delivers the normal power output at a power-factor of 80 per cent. At 100 per cent power-factor the voltage variation from full load to no load does not exceed 7 per cent.

TRANSFORMERS.

Adjacent to the power house with which it possesses one wall in common is located the transformer house, which is practically a three-storied building, 75 ft. in width and 85 ft. long. This building contains four banks each consisting of three transformers. Each transformer is rated at 2000-kw, 2000 to 44,000 volts, and is insulated with oil and cooled by water. The full load efficiency of each transformer is 98.4 per cent, the regulation at full load is .95 per cent for 100 per cent power-factor, and 2.9 per cent for 85 per cent power-factor. Cooling water is supplied by gravity through pipes tapped into the heads of the exciter turbine cases.

FIG. 2.—TURBINE FEEDER PIPES.

The transformer tanks are designed to withstand a pressure of 150 lbs. per sq. in. and in order to provide against damage in case of explosion each tank is connected through a relief valve to a 6-in. vent pipe discharging outside of the building. Transformers are mounted on flanged wheels and stand in their respective compartments on 30-lb. rails supported on concrete pedestals. A transfer carriage operates upon a track in front of each row of transformers, and any of these may readily be removed from its support onto the carriage and thence into the power-house, where it is accessible to the crane. All transformers are connected to a pipe system by which carbonic acid gas may be admitted to the tanks in case of fire. The carbonic acid gas generator and pressure tank are located in the basement of the transformer house, and from them a main pipe extends to a cabinet in the low-tension switching room, where the distributing pipe to the several transformers branch off. Each branch pipe is provided with

a valve numbered to correspond to that of the transformer to which the pipe is connected, so that by opening the proper valve a fire may be extinguished in any tank. A pipe lead also wasted into the tailrace. For the oil supply to the high tension apparatus two pipe leads are taken up to the second floor, where they terminate with hose bibs in floor boxes. The pump for

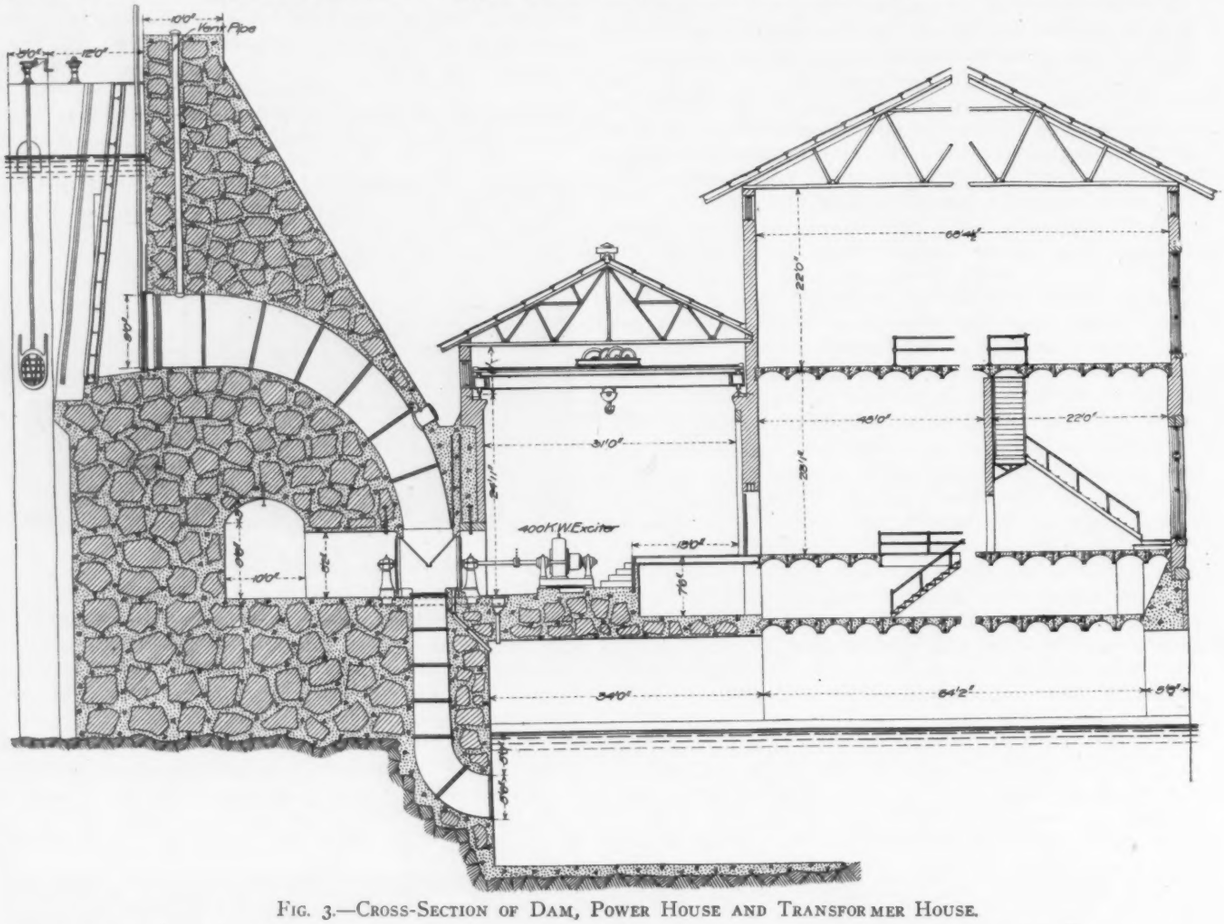


FIG. 3.—CROSS-SECTION OF DAM, POWER HOUSE AND TRANSFORMER HOUSE.

extends to the second story, where by means of a hose connecting from a floor box any of the apparatus there may be reached.

Oil for the transformers may be supplied either by gravity or under pressure from a storage tank outside of the building, or by reversal of a pump it may be drawn off and returned

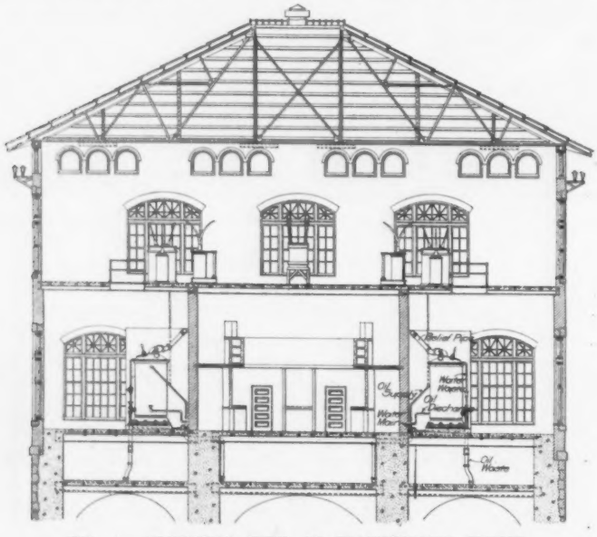
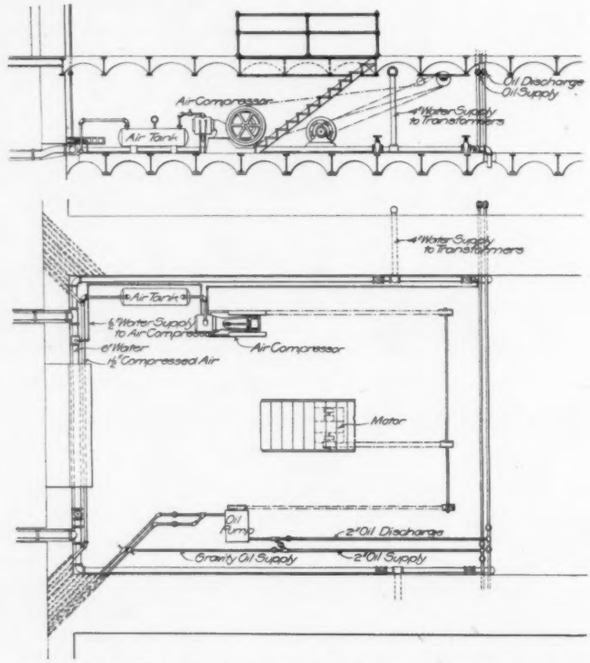


FIG. 4.—SECTIONAL VIEW OF TRANSFORMER HOUSE.



FIGS. 5 AND 6.—ELEVATION AND PLAN OF OIL, WATER AND AIR SYSTEMS.

through a filter to a storage tank. Should the oil have deteriorated to an extent not permitting its further use it may be

this system is located in the basement of the transformer house and is an electrically-operated triplex machine.

SWITCHES.

For the control of each generator there are provided an instrument post and a control pedestal. Each instrument post has one 3000-volt voltmeter, one 1200-ampere ammeter, one 4500-kw polyphase indicating wattmeter, and one 400-ampere field ammeter. In addition to the above there are two synchronizers, two frequency indicators, and four 5000-volt bus-bar

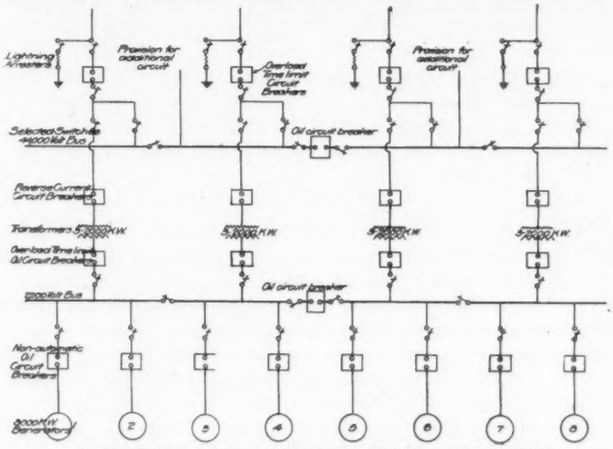


FIG. 7.—SCHEMATIC DIAGRAM OF SWITCH CONNECTIONS.

voltmeters, distributed among the several posts. Each control pedestal contains a switch for the remote control of one non-automatic oil circuit-breaker, one 400-ampere, double-throw, double-pole field switch, a rheostat hand wheel and sprocket chain, an eight-point voltmeter receptacle, a synchronizing lamp receptacle, a meter shunt and a lamp reflector. The lamp and reflector are so arranged that a bright light is thrown on the meters, the supporting pedestal of which is located immediately behind the control pedestal.

The main switchboard contains two transformer panels, two double-circuit feeder panels, one station panel and two blank panels.

The low-tension bus and oil switch structure is built up of concrete slabs and steel framing. The oil switches are contained in the cells of the substructure, and the bus bars are carried in compartments built above these and around three sides. A gallery of structural steel and concrete provides accessibility for the operation of the selector switches. A sectionalizing oil circuit-breaker cuts the bus-bars into two sections, and by means of the selector switches mentioned each section may be further divided. It is therefore possible with this arrangement to operate in multiple the entire equipment, half of it or any pair of generators. Bus-bars are made up of five strips of copper clamped together, each strip being ¼ in. x 3 ins. They are connected to the low-tension side of the transformer through automatic oil circuit-breakers, the connection consisting of two 1,000,000-cm lead-covered cables per phase.

Leads from the high-tension terminals of the transformers are taken through a well in the floor of the second story, where they connect through oil switches either to high-tension bus-bars or feed directly into the line. Here, again, flexibility of control is secured by an arrangement of selector switches, whereby any bank of transformers may be operated or thrown on the bus-bars for multiple operation. Current for operating all high-tension circuit-breakers is obtained from oil-insulated series transformers. All high-tension wires and bus-bars consist of 1-in. copper tubing. The selector switches and bus-bar insulators are supported on a steel structure of latticed girders.

In order partially to relieve the transformer winding of the excessive strain due to surges in the line, choke coils of the oil-insulated type are placed between the transformers and their respective high-tension bus oil switches. The lightning arrest-

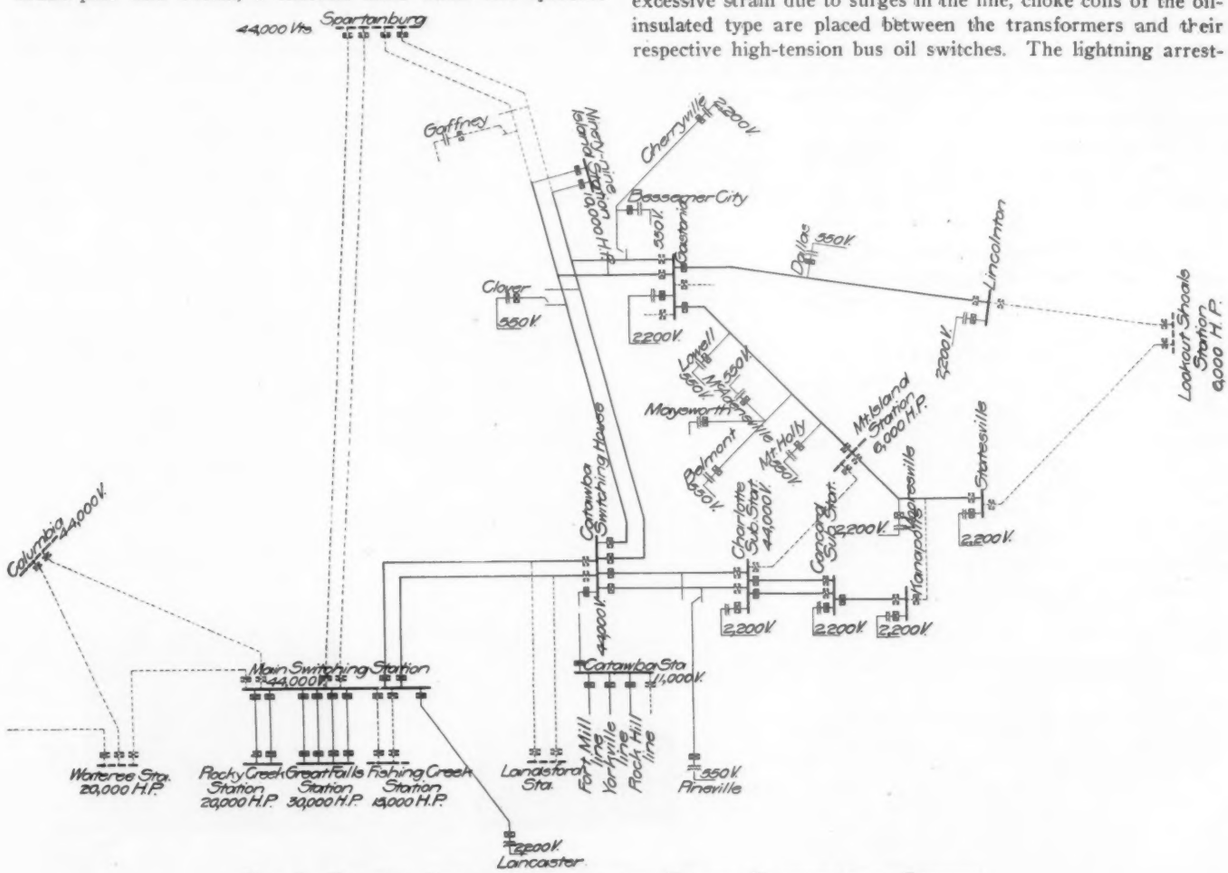


FIG. 8.—DIAGRAM SHOWING PRESENT AND FUTURE TRANSMISSION CIRCUITS.

ers are of the single-pole, low-equivalent type, for which the manufacturers claim great efficiency both as to the prevention of rise of potential on the line and the suppression of the arc after the discharge. The complete electrical equipment was furnished by the Westinghouse Electrical & Manufacturing Co.

TRANSMISSION LINES.

At the present time electricity is transmitted from the Catawba station to Rock Hill, Charlotte and Fort Mill at 11,000 volts, on wooden poles. Upon the completion of the Great Falls station the line to Charlotte will be operated at 44,000 volts and will be extended to Concord, N. C., while an additional line to Gastonia will also be operated at the higher e.

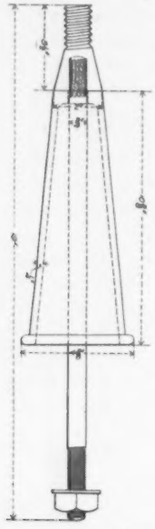


FIG. 9.—INSULATOR PIN.

m. f. Temporarily, at least, the distributing point of the system will be the Catawba station, at which a transformer house is being erected to contain three 2000-kw 11,000 to 44,000-volt transformers for running the two stations in parallel, a trunk line supported on steel towers being built from Great Falls to the Catawba station.

In the diagrammatic layout of the transmission system all solid lines are either in operation or under construction. The dotted lines indicate future installations. See Fig. 8.

WOODEN POLES.

The present 44,000-volt transmission lines are being placed on two single-circuit wooden pole lines located side by side. A 35-ft. cypress pole is used to support each circuit of No. 2-0 six-strand hemp core cable. The three cables form approximately an equilateral triangle, whose sides are 6 ft. in length, two of them being supported on a cross arm and one on a special cast-iron bracket, which fits snugly over the top of the pole. Thomas insulators 13 in. high and 12 in. across the top and Locke insulators, 12 in. x 12 in., are used indiscriminately. With a view to meeting general adaptability a special insulator pin was designed. This consists essentially of a cast iron sleeve through which passes a ¾-in. bolt. A cast-iron bushing is cemented into the insulator and into this bushing the through bolt is screwed. By the use of such a pin, strength is assured and in broken insulators the bushing only is lost, while for whatever support it may be desired to use them on it is necessary merely to use a bolt of greater or lesser length. The cross arms are of long leaf yellow pine 4¾ in. x 5¾ in. x 7 ft. long dipped for 15 minutes in carbolineum avenarius at a temperature of 65 degrees C. The increase in the weight of the cross arm after having been subjected to the above treatment is about 4½ per cent.

A lightning wire is supported by a 2½-in. galvanized pipe flattened at each end. The pipe is fastened to the pole by means of the cast-iron bracket. See Fig. 10.

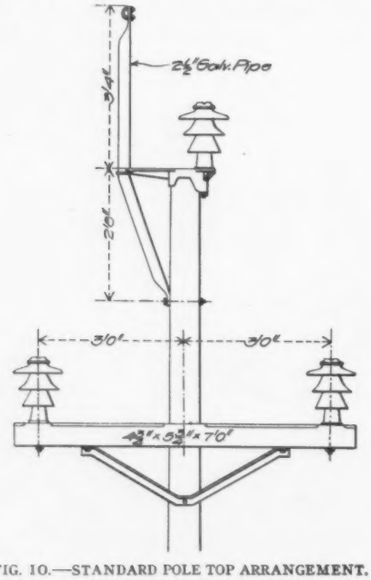


FIG. 10.—STANDARD POLE TOP ARRANGEMENT.

STEEL TOWERS.

The transmission scheme contemplates the eventual construction of a circuit trunk line into which all power stations shall feed, and on this circuit, at least, galvanized-steel towers are to be used throughout. These towers are designed for two circuits, each circuit having a ground wire placed above the highest transmission wire in such position that a line drawn through this ground wire and the upper transmission wire forms an angle of 60 degrees with the horizontal.

A six-strand cable with hemp cord, the equivalent of No. 3-0 wire is used for the main conductor, and a solid iron wire is used for the ground conductor. The transmission wires are located at the corners of an equilateral triangle, the sides of which are 6 ft. in length. The towers also support a telephone line strung 27 ft. above the ground and passing through the center of the tower. The spacing of towers is approximately 420 ft., the average number per mile being twelve. Where the ground is moderately level a standard tower 35 ft. in height from the ground line to the lowest conductor is used, while for very uneven ground there have been provided two special height towers of 43 ft. and 50 ft., respectively. The 35-ft., 40-ft. and 50-ft. towers weigh 2400. 3000 and 3500 lbs., respectively, and are all of the same type of construction. The special towers were furnished by the U. S. Wind Engine & Pump Company, of Batavia, Ill., while the standard towers were supplied by the Aermotor Company, Chicago, Ill.

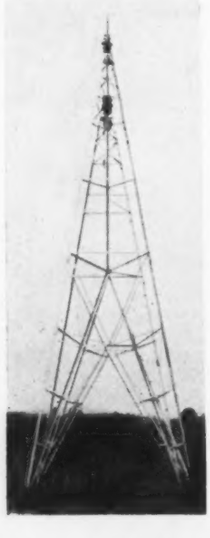


FIG. 11.—END VIEW OF TOWER.

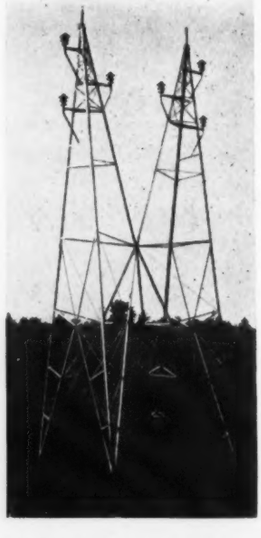


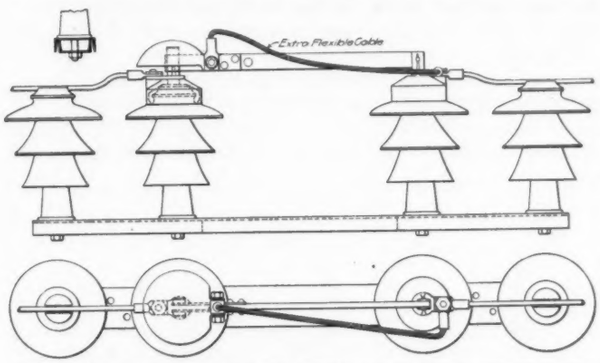
FIG. 12.—PARTIAL SIDE VIEW OF TOWER.

The towers are essentially twin towers, each half being joined to the other at a point midway between the base and the top of the tower proper. The 3 x 3 3/16-in. corner angles

of each half, as viewed from a point normal to the line, form A frames, and are clamped together at a point 2½ ft. above the highest cross arms, while the two other main members, 3 x 3 x ⅛-in., of half of the tower, as viewed from the same point, form A frames at one-half the height of the tower, and riveted together. To these members is riveted a 3 x 3 x 3/16-in. third member, which is clamped to the corner angle at the top. Each half of the tower, therefore, has four main members from the ground to a point equal to one-half of the height and from this point up only three.

As viewed in the direction of the line the corner angles are upright with diagonals from the apex and from the base to the center of the tower. All main members are securely held together by means of tie rods and angle iron struts. The two halves of the tower are joined together with a batten plate. The width of the base in the direction of the line is 13 ft. 2 in., while in the opposite direction it is 14 ft. 6 in.

For each conductor there is provided a separate cross arm consisting of two 2½ x 2½ x ⅛-in. angles placed back to back, the pin end of each cross arm being braced to the tower by a 2-in. pipe. The insulator pins are made of standard 2-in. pipe drawn down at the top and threaded to take firm hold in the top of the insulator, into which they are cemented. A



FIGS. 13 AND 14.—SIDE AND TOP VIEWS OF THE LINE DISCONNECTING SWITCH.

Thomas insulator with a special bottom petticoat is used. This insulator is 13 in. high, having a cap 12 in. in diameter.

The line is suitably transposed and is sectionalized at each point of partial transposition. This combination of connections requires the use of four of the 12-ft. x 12-ft. towers with a special insulator flange bolted between the two pairs of towers. Five sets of selector switches are so arranged that a crossover from one circuit to the other may be effected and any section may be cut out for repairs in case of a breakdown. For outside work a special disconnecting switch has been designed, the insulators of which are mounted on a 5-in., 6½-lb. channel and in place of the customarily used copper bar a steel bar is used. This has a copper contact and the circuit is made through a flexible cable.

The organization of the Southern Power Company was effected under a New Jersey charter with an authorized capital of $7,500,000. Of this amount $2,500,000 was set aside as preferred stock, yielding 7 per cent cumulative dividends, the remaining $5,000,000 being common stock. On Oct. 24, 1906, the capital stock was increased to $10,000,000, the additional $2,500,000 apportioned to the preferred stock.

The property holdings for this entire development aggregate nearly 9,500 acres, much of which could not be leased for agricultural purposes, and on such land 750 pecan trees were planted, which in time are expected to bring good returns.

The officers of the Southern Power Company are: Dr. W. Gill Wylie, of New York, president; B. N. Duke, of New York, first vice-president; W. S. Lee, Jr., of Charlotte, N. C., second vice-president and chief engineer; R. B. Arrington, of New York, secretary and treasurer; L. C. Harrison, of Charlotte, assistant secretary; W. H. Martin, Jr., of Charlotte, assistant treasurer.

Economical Conductor Section.

By Frank G. Baum.

KELVIN'S law for the most economical conductor has been stated in a great many ways, and it will do no harm to repeat some of the statements and to try to put the matter in form for quick reference. Lord Kelvin stated the law in 1881 as follows: "The most economical area of conductor will be that for which the annual interest on the capital outlay equals the annual cost of the energy wasted."

This has been put in a more exact way by Gisbert Kapp: "The most economical area of conductor is that for which the annual cost of energy wasted is equal to the annual interest on that portion of the capital outlay which can be considered to be proportional to the weight of metal used."

Prof. George Forbes, in his Cantor lectures in 1885, called that portion of the cost of the distributing system which is proportional to the weight of the metal used, "the cost of laying one additional ton of copper;" and he shows that, for a given rate of interest charge (inclusive of depreciation), and a given cost of copper, "the most economical section of the conductor is independent of the e. m. f., and of the distance, and is proportional to the current."

Prof. Forbes at the same time published some tables to facilitate the calculations; and Prof. H. S. Carhart has enlarged them, and reduced the values to United States money.

It is necessary for the engineer in solving problems, when he has a great many to solve, to be able to give quick and accurate practical solutions. A problem frequently encountered relates to the most economical size of conductor for a certain case. An attempt is here made to put this great law in the best working form for practical purposes.

Let it be assumed that the poles are up, and that there is a place on the arm for a circuit. Assume that the cost of the insulators is not affected by the size of the conductors, and that the voltage is determined from other considerations. (These are the usual conditions.)

Let A = Interest cost per year of the pole structure ready to receive the wires.

B = Interest cost per year of the conductors in place.

C = Value of energy lost in transmission in one year.

Then the total annual cost of transmitting the energy will be

$$Y = A + B + C.$$

With interest at 5 per cent $B = .05\, K_1\, (.003)\, LD^2$

where K_1 is the cost per pound of copper wire in place, L is the length of the circuit in thousand feet, and D^2 represents the circular mils in the wire.

$$\text{Also } C = KI^2\, 10.5\, \frac{L}{D^2}$$

where K is the cost per kw-year of the lost energy in dollars, and I is the current used in transmission. The equation for Y then becomes

$$Y = A + .05\, K_1\, (.003)\, LD^2 + KI^2\, 10.5\, \frac{L}{D^2}$$

To find when Y is a minimum, the equation should be differentiated with respect to D and equated to zero. There will then be obtained the result which mathematically expresses Kelvin's law. (Assuming A to be constant.)

Interest cost = Cost of lost energy. Or

$$.05\, K_1\, (.003)\, LD^2 = KI^2\, 10.5\, \frac{L}{D^2} \text{ or}$$

$D^2 = I\sqrt{\frac{K}{-}}\, 265$; that is to say, the *circular mils per ampere* to be used for *any voltage, any distance and any amount of power* is given by the equation

$$D^2 = 265\sqrt{\frac{K}{K_1}}$$

As shown by this equation, the cross section is a factor solely of the current used in transmission.

Assuming values of K from zero to $200, and for K_1 from 15 cents to 30 cents pound, the curves of Fig. 1 are obtained. By the use of these curves one may quickly determine the size of wire to use for any given case.

Care must be exercised in taking as K that value for which the energy representing the line losses can be produced, and not that for what this energy can be sold. As this point has been in contention, an example will make it clear.

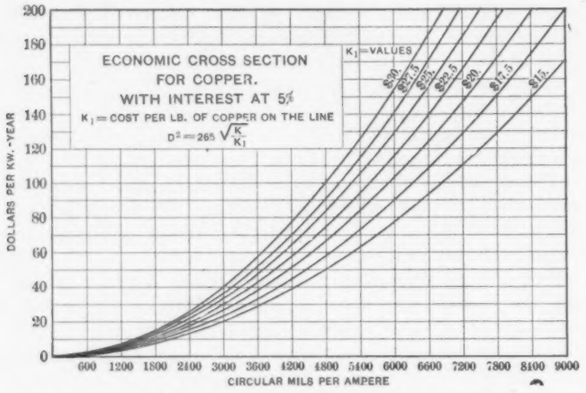


FIG. 1.—ECONOMICAL SIZES FOR COPPER CONDUCTORS.

Suppose a certain size wire costing $10,000 gives a power loss of 10 kw, involving a cost of, say, $48 per kw-year to produce on the line, but selling for $240 per kw-year. The interest on the wire at 5 per cent is $500, and the value of the lost energy based on the cost to produce is $480 per year. The line losses, if sold at $240 per kw-year, would bring $2400 per year, and one might argue that this is the value of the lost energy. In order to reduce the $2400 to $1200, or by one-half, it would be necessary to double the size of wire, or to add $500 to the interest cost. The extra investment of $10,000, costing $500, saves 5 kw continuously, the energy of which can be produced for $240 per year. If the energy can be produced for $240 in the power house, it is clearly a mistake to try to save the same amount at an interest cost of $500.

It is also necessary to take as the cost of the conductor the value represented by it in place on the line.

Fig. 2 gives a set of curves similar to those of Fig. 1, but

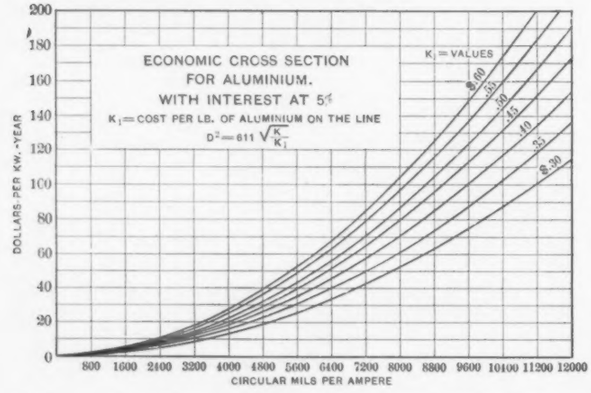


FIG. 2.—ECONOMICAL SIZES FOR ALUMINIUM CONDUCTORS.

for aluminium, with aluminium varying in cost from 30 cents to 60 cents per lb.

The equation for determining D^2 for aluminium is

$$.05\,K_1\,(.009)\,LD^2 = KI^2\,168\,\frac{L}{D^2},$$

or *circular mils per ampere* is

$$D^2 = 611\sqrt{\frac{K}{K_1}}$$

As seen above it is necessary to know only the cost per pound of the conductor on the line and the cost per kw-year to the company of the lost energy. From these values the circular mils per ampere for the most economical condition can at once be determined from the accompanying curves. To determine the size of the conductor in circular mils, the value of the current is ascertained in the usual way, and the circular mils per ampere multiplied by the current. To render the current determination less laborious, Curve 3, which is based on the equation $P = EI\sqrt{3}$ has been drawn, from which the current for any given amount of power at any voltage may be determined. The line voltage is taken up to only 15,000, but, by multiplying the vertical scale by any number, say, 4, 6 or 10, for higher voltages, and then passing to the proper kw curve, and then dividing the current by 4, 6 or 10, the same curve may be used for any voltage. The curve gives the current at unity power factor. To obtain the current to be used in curves 1 and 2 for any other power factor, divide the current as obtained from curve 3 by the factor power.

It is not always permissible to consider the pole structure as not being affected by size of conductor, but generally in transmission and ordinary distribution work such is the case, for the reason that it will be economical in the first place to transmit the energy at as high a voltage as possible. This immediately determines the wire within one or two sizes; that is, for example No. 2-0 or No. 3-0. Now the structure will not be changed for a small change in the size of the conductor by one

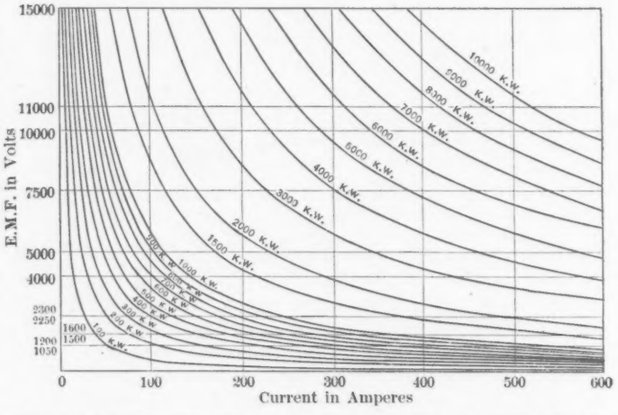


FIG. 3.—VALUES FOR THE CURRENT PER WIRE IN THREE-PHASE CIRCUITS.

or two numbers. Moreover, in pole line work the pole structure is generally determined independent of the size of conductor, as the structure is made heavy enough to carry a size which is assumed sufficient for future needs. For overhead uninsulated work, therefore, the curves as determined may be applied directly.

In applying the curves use should be made of the mean annual value of the current employed in transmission as given in Foster's *Electrical Engineers' Pocketbook*, page 96.

Another interesting problem arises in practice. Assume that use is not made of the most economical size, but a smaller or a larger. What is the effect upon the total cost of delivering the energy? The equation for the total cost is

$$Y = A + B + C;$$

A being fixed, the problem is to determine how the cost is affected by varying B and C. It has been noted that the most economical condition exists when B is equal to C. For this condition suppose, for example, that the sum of B and C is 100 per cent. That is, neglecting A,

$$Y = 50 + 50 = 100$$

Now, if the interest cost on the conductor is halved the losses are doubled. In this case

$$Y = 50 \times 2 + \frac{50}{2} = 125$$

That is, the sum of $B + C$ is increased 25 per cent by doubling the losses, therefore 25 per cent more is paid for delivering the energy to cause a decrease of one-half the outlay for copper. The above relation may be expressed generally as follows:

$$B = 50a$$

$$C = \frac{50}{a} \text{ and}$$

$$Y = 50a + \frac{50}{a},$$

a being proportional to the weight of the conductor.

The results are shown in Fig. 4. As seen, when the interest cost on the conductor and the value of the lost energy are equal, or when each is equal to 50 per cent, the total cost is 100 per cent, which is the minimum, as given by Kelvin's Law. If C is increased to, say 100, then B, the conductor investment, decreases to 25, giving a total of 125. If the investment for conductor is decreased from 50 to 40, or by 20 per cent, the losses are increased from 50 to 62.5, or the cost of delivering the energy is increased from 100 to 40 + 62.5 = 102.5, or by 2.5 per cent.

The above shows that the investment may be decreased by 20 per cent with no great increase in the total cost of delivering the energy. This is especially true when the fixed cost due to pole structures, operation of lines, etc., is taken into consideration.

To get the total cost

$$Y = A + 50a + \frac{50}{a};$$ the value of A must

be added to the upper curve. $Y = A$ is the equation of a straight line parallel to a, or the x axis, and will therefore, not affect the position of the Y curve.

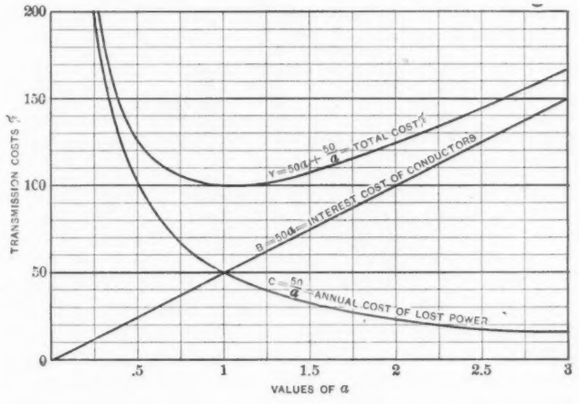


FIG. 4.—VARIATION OF COST WITH INVESTMENT FOR CONDUCTOR.

For example, if the sum of these latter costs, A, amounts to 100, the total cost of delivering the energy for the most economical condition would be 100 + 100 = 200, and for a decrease of 20 per cent in the conductor investment, the cost would be 202.5, or an increase of 1.25 per cent. If, on the same assumptions, we double the losses and reduce the copper investment one-half, the total cost would be 100 + 125 = 225, or an increase of 12.5 per cent.

With the price of conductor fluctuating as it is, it is almost necessary to make use of curves as shown by Figs. 1 to 4 to ascertain more accurately the size of the conductor which should be installed.

As will be noticed, the curves of Fig. 4 are plotted in percentage, and the relative positions will not be affected by a change in the price of the conductor or in the value of the losses.

Voltmeter Compensator for Direct-Current Circuits.

BY F. E. HASKELL.

As is generally known, there is a certain piece of alternating current apparatus, the compensator, which enables the station voltmeter to indicate the e. m. f. at the distribution point. It is possible to accomplish the same result with direct-current equipments, and it is believed that a description of the scheme employed for this purpose will prove of interest.

In the accompanying diagram let $A\,B$ be the sending end and CD the receiving end of the transmission line, and let E and E' be the respective voltages. On a resistance connected across the sending end, let there be chosen some definite point, H, so that, for example,

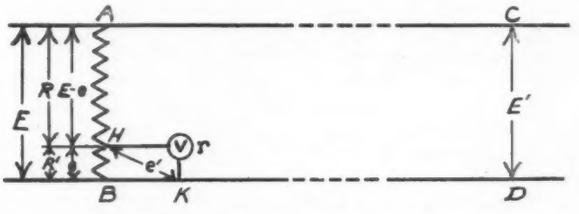
$$\frac{R+R'}{R'} = 1000$$

R being the resistance from A to H and R' the resistance from H to B. Select a point on the transmission line, K, such that the resistance of $B\,K$ is equal to one-thousandth of the total resistance of the transmission line. Connect the voltmeter between H and K. Let e be the voltage from B to H, and e' that from K to H.

From the relation of R to R' it is seen that $e = \frac{E}{1000.}$ Also the voltage drop from B to K, E_1, is one-thousandth of the line drop; that is, $\frac{E-E'}{1000} = E_1$. Since the voltmeter reads $e - E_1$

$$e' = e - E_1 = \frac{E}{1000} - \frac{E-E'}{1000} = \frac{E'}{1000}, \text{ or}$$

the voltmeter reads one-thousandth of the e. m. f. at the receiving end. Thus, a voltmeter with a suitable scale could read the e. m. f. at the receiving end. For instance, in this case, a



VOLTMETER COMPENSATOR CIRCUITS.

millivoltmeter would be a suitable instrument to connect between H and K. When the millivoltmeter reads 1 there is .001 volt across it and at the same time the electromotive force E' is equal to one volt.

There is one other factor thus far neglected which should be taken into consideration. To make the heating effect and energy loss in R and R' low, the resistance itself should be made high. This means that the current from B to A would be low and the voltmeter current, therefore, comparable to it. In short, the voltmeter current would introduce an error; that is, the drop through R would be greater, in proportion to its resistance, than that through R'. This means that the drop through the voltmeter would be less than it should be. Of course, when no current flows through the voltmeter there is no error and the reading should be, and is, zero. The greater the current through the voltmeter the greater will be the error. However, this error follows a very simple law. If when the voltmeter should read 25 volts it reads 24 volts, then when it should read 50 volts it will read 48 volts, when it should read 100 volts it will read 96 volts. Therefore, if the voltmeter is properly calibrated for the resistance used or the resistance

is correctly selected to suit the voltmeter the equipment will operate without error. The constant by which it is necessary to multiply E' to get e' in this particular case is no longer .001, but .001 × .96.

The general formula for any case may now be derived. Let,

$$\frac{R+R'}{R'}=m$$

Also let,

$$\frac{E-E'}{E_1}=m$$

Since the current in $A\,H$ is the sum of the currents in $B\,H$ and $K\,H$,

$$\frac{E-e}{R}=\frac{e}{R^1}+\frac{e^1}{r}$$

From these three formulas the final formula is obtained by simple algebra,

$$e'=E'\frac{r}{mr+R}$$

which shows that there is a constant ratio between e' and E' under all conditions. The formula also allows one to determine the values which must be selected for the several resistances in order to give the ratio of e' to E' any value desired.

To make the use of the above formula perfectly plain one numerical example will be given. It is, of course, desirable to use a standard voltmeter, say, a millivoltmeter. The problem will that be to have a reading of 100 divisions on the millivoltmeter indicate, say, 100 volts at $C\,D$. In other words, the millivolts across $H\,K$ should be equal to the volts across $C\,D$; that is, the e. m. f. e' should be one-thousandth of the e. m. f. E'. In terms of the formula this would be,

$$e'=\frac{E'}{1000}$$

which means,

$$\frac{r}{mr+R}=\frac{1}{1000}$$

If the resistance of the millivoltmeter is 10 ohms and R is chosen as 5000 ohms, the formula becomes

$$\frac{10}{m\times 10+5000}=\frac{1}{1000};\ \text{or}\ m=500$$

To obtain R'

$$\frac{R+R'}{R'}=m;\ \frac{5000+R'}{R'}=500;\ R'=5000/499=10.02+\ \text{ohms.}$$

If m works out negative it shows that too high a value has been chosen for R. Since $\frac{E-E'}{E_1}=m$, the resistance of $B\,K$ for this case, should be one five-hundredth of the total line resistance.

One word might be said as to the method of installing such an apparatus. With a millivoltmeter and the specially designed "three-way multiplier" as described above, the first step would be to connect A, H and B. Then short-circuit $C\,D$ and raise the voltage at $A\,B$ until a suitable current flowed. Find K as that point where the voltmeter reads zero.

If, when installing such a compensator equipment, it is inconvenient to design the "multiplier" beforehand, the point H can be found by trial. For this purpose it would be convenient to compare the voltage at the station when the line is on open circuit with the indications of the millivoltmeter. That is to say, if the millivoltmeter indicates the same e. m. f. as the station voltmeter when the line is on open circuit, and reads zero when the line is short-circuited at the sub-station, the compensator equipment is properly adjusted for all loads.

Automatic Calling Device for a Wireless Telegraph Station.

By W. R. Carroll.

The writer's attention has been called to the article by Mr. T. H. Reardon in the March issue of the Electrical World describing an automatic calling device for a telegraph line. At about the time this article appeared I had constructed and put into use a similar, though a more elaborate device for automatic calling with a wireless telegraph transmitter. The wireless station where this was put in use is the one on Yerba Buena Island, San Francisco Bay, under control of the United States Navy Department, which station did excellent service during the San Francisco disaster of a year ago.

In addition to the wireless telegraph equipment of this station there is a wire telegraph system of the Postal Telegraph Co., connecting with the Commercial Pacific Cable Co's., line to Hawaii and the Orient, and also local and long distance telephones. As a visitor to the station one day remarked, the island has connection with the outer world through air, under water and over land.

The wireless telegraph station communicates regularly with

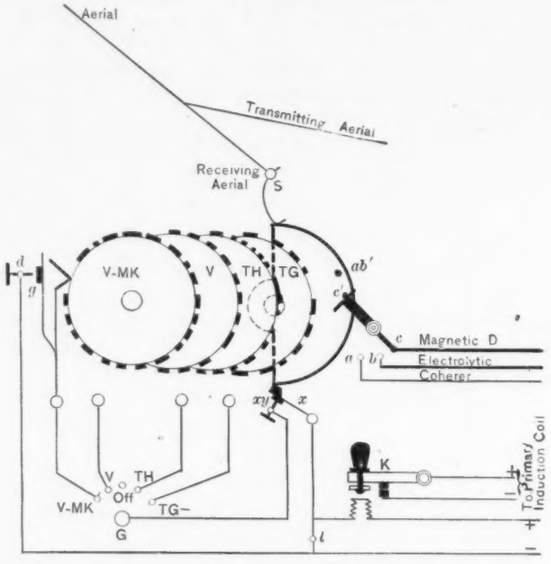


FIG. I.—WIRELESS TELEGRAPH AUTOMATIC CALLING DEVICE.

the Navy's wireless stations at Mare Island on San Pablo Bay 20 miles away and with Farallone Islands 35 mile at sea beyond the Golden Gate. The transmitting apparatus is similar to that in use at all modern wireless stations. The receiving devices include a coherer system with tape recording apparatus; an electrolytic receiver with high resistance double-head telephone receivers and a magnetic detector so arranged that it can be left attached to the transmitting aerial at all times even when sending. By this arrangement it becomes possible for the receiving station to "break" the sending station, just as is true on land lines, and to secure at once a repetition of lost signals instead of waiting until the sending has ceased as is done with all other receivers.

The auto-sender is shown in the accompanying diagram. There are four transmitting or type wheels and a half-wheel or aerial control wheel as it may be called. The calling wheels bear the call letters of the different stations, *TG* being Mare Island and *TH* Farallones. The wheels *V* and *V-MK* are for sending out a continuous train of *V*-signals for the adjustment of another station. All of these wheels and the half-wheel are on a common shaft which also carries the drive wheel of a set of gears which propels the traveling iron core of the magnetic detector and the whole is belted to a small motor. The speed of the motor is controlled by a slide rhoestat, and a telephone hook switch in the circuit serves to set the mechanism

amoving when the telephone is taken up for receiving or whenever it is desired to start the automatic sending. Underneath the lever of the sending key "*K*" is an armature and an old pair of relay magnets having a resistance of 75 ohms, which actuated by a shunt circuit from the main battery serves to manipulate the key whenever the circuit is closed at one of the contact points "*d*" by the flat spring *g* when the latter is pushed into contact by the teeth on the rim of the type wheel. A condenser or a lamp "*e*" of suitable resistance is shunted across this make-and-break to obviate the spark and render the signals sharp and

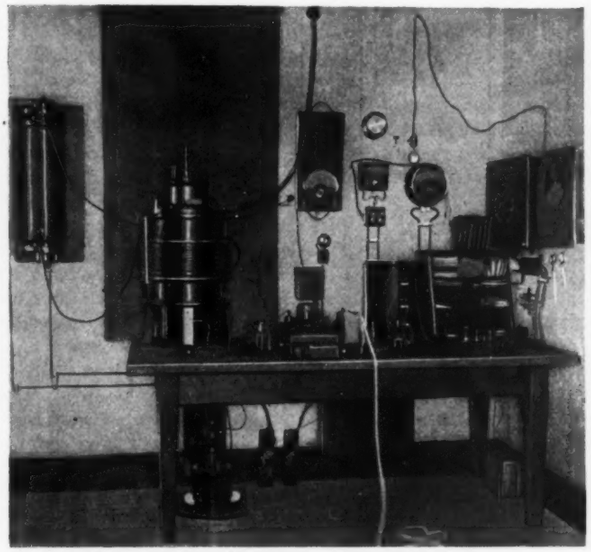


FIG. 2.—WIRELESS APPARATUS ON YERBA BUENA ISLAND.

clear. This form of make-and-break is well adapted for telegraphic work. The switch *G* connects to the wheel desired or it opens the circuit entirely for hand sending with key "*K*."

The half wheel is not fastened rigidly to the shaft but is held by means of a compression spring under a nut on the end of the shaft. If it is desired to send *V*-signals or call continuously, when the detector is used the aerial switch "*A*" is moved to the point *c* and the back arm catches on a stop pin c^1 on the half wheel thereby stopping it and placing the aerial in permanent contact with the detector *D*. If the detector is not to be used the back arm is placed on a stop pin ab^1 just an instant after the spring brush *s* has slipped off the segment and the aerial is no longer in contact with the half wheel. The contact *xy* at the spring brush *x* at the opposite side of the half wheel serves to keep open or close the magnet circuit as the segment revolves. When the switch *A* is on either *a* or *b* and the half wheel is free to revolve it closes the magnet circuit just an instant after the aerial spring *S* flies open, and when the segment moves around and again engages the aerial in contact the magnet circuit is broken and the transmitting signals cease.

The signals on each half of the wheels *TG* and *TH* are composed of the letters three times repeated and signal *TI*, the last being the call letter of Yerba Buena station. When the control wheel is in motion the magnet circuit is broken one-half of the time. By this arrangement the calls are not continuous but intermittent and during the interval the coherer or electrolytic receiver is thrown in circuit and the station called may reply and business then proceed in the usual way. If it is desired to call continuously the back arm is placed in contact with pin *b*.

When the *V* or test signals are sent out signed *MK*, as occurs once in each revolution of the wheel occupying about one-half minute, the receiving station is aware that the sending station is using the magnetic detector and that it can "break" and interrupt the signals when enough test signals have been received to have secured the desired adjustment. Should the sending station operator be called away to some other duty he switches over to the plain *V* wheel and allows it to continue sending for some prearranged time as agreed upon for adjusting purposes.

In order to have type wheels for any call letter desired, a wheel is made with changeable teeth. With floating (ship) wireless stations coming in contact every day with new stations this arrangement would be quite useful. The type wheel and make-and-break as used in this device are what is known as the Omnigraph transmitter and are made by The Omnigraph Co. of New York.

The Technical Man and Simplified Spelling.

BY TRACY D. WARING.

Here is an extract from a letter written to Benjamin Franklin by his sister:

> "Pray forgive the very bad spelling, and every other defect, and don't let it mortify you that such a scrawl came from your sister."

And here is Franklin's answer:

> "You need not be concerned in writing to me about your bad spelling, for, in my opinion, as our alphabet now stands, bad spelling, or what is called so, is generally the best, as conforming to the sound of the letters and of the words."(*)

Benjamin Franklin was a wise man, a discerner of truth, a lover of simplicity, ahead of his own times, and ahead of ours.

The instinct and training of the better class of technical and scientific man, of our own time, or of any time, must mould and model his character to love consistency, by which truth is tested and co-ordinated, to discern the simple in the complex, to analyze the complex into its simpler elements, accurately expressing the complicated in terms of the simple, casting out the trivial and superfluous, effecting economy in thought and action, in short to strive for—truth—accuracy—simplicity—economy.

The familiarity with mathematics, which the trained engineer necessarily must have, brings to him a live appreciation of the value of an adequate system of symbolism, for the expression of ideas. And is not this also the chief, yes the only true, aim of any spoken language—to express our thoughts clearly, accurately, concisely and, so far as may be, euphoniously? And is not the only true function, of the corresponding written language, to record the spoken expressions, accurately, concisely, legibly and, so far as may be, esthetically?

This granted, and we find ourselves at once arrayed on the side of those, who appeal to the common sense of all, to cast what slight weight, each of us may properly cast, toward making our spelling a little less foolish, a little less fantastic. (**)

If there are any timerous spirits, who read this, those who are afraid to look first principles in the face and accept the consequences, or those who scoff at what they cannot comprehend, let them stop right here, this is not written for them, I am addressing myself as a technical man to technical men, to people of open mind and liberal understanding, to people who, I hope, are charitable towards minor faults and errors, who can discriminate between the fundamental and the trivial, to those govered by principles rather than by prejudice.

Our written language, however far it departs from the ideal, is on a phonetic basis. We employ 26 letters, each letter (generally) representing an elementary sound, or like the vowels (a, e, i, o, u) standing each separately for several elementary sounds, or an elementary sound may be represented by a combination of letters (digraphs ch, dh, ng, sh, th, zh). Besides these we have the diphthongs which can be satisfactorily represented by the combination of two vowels.

Now the trouble is, there are at least 32 elementary sounds in our spoken language, requiring for concise and adequate phonetic representation 32 different symbols. Our alphabet has but

(*) The Many-sided Franklin, by Paul Leicester Ford.
(**) Adapted from the words of President Roosevelt.

26 letters, and of these some are duplicated in sound, [(hard c) = k; soft c is well represented by s; q = (hard c) u; x = (hard c) s;] leaving but 23 letters, if the duplicates (k, q, x) are excluded; so that, there are 9 elementary sounds without letters. Of these nine, three are vowels sounds, and the remaining six are the combinations, at present represented by ch, dh, ng, sh, th, zh, mentioned above as "digraphs," each of which it were better to represent by a single symbol; and for the three vowel sounds, three new symbols must be adopted, to fulfil the functions which a, o, u are generally, and ambiguously, called upon to perform.

The 32 elementary sounds, to which we have just referred, include eight vowels, each of which may have a long or a short sound, the long sound of which may, appropriately, be represented by a distinguishing mark (diacritic), applied to the symbol of the shorter sound.* So that, if we choose to call each of these vowels modifications a separate elementary sound, or its symbolic representation a separate symbol, we have in all 32 + 8 = 40 elementary sounds to be represented by as many separate symbols. Such a system of symbols has been called the 'Scientific Alfabet."

Shall we, can we, adopt such a system for the purpose of every day life, for which our present unsystem is used?

The increase from 26 to 40 symbols seems at first sight hardly in the direction of simplification, the change however would not startle the stickler for ancient usage, since that venerated ancestral-relative of our language, Sanskrit, has forty-nine letters in its alphabet. Ancient practises, however, are not very strong arguments one way or the other.

Those of us who have taken some interest in the history of mathematics are aware how impossible it was to make any great progress, in arithmetical science, under the Roman I, V, X, L, C, D, M, system of notation, and not until, with the zero invented, and the first three symbols, which had sufficed to express the first nine natural numbers, had been expanded into nine distinctive characters, giving us the ten digits 0, 1, 2, 3, 4, 5, 6, 7, 8, 9 of the Arabic system, was any great progress possible.

The analogy is perhaps not very close, but illustrates how an increase in symbolism may lead to an enormous gain in simplicity. (**)

Mr. Brander Matthews, member of the Simplified Spelling Board, has said: "Strictly 'phonetic' spelling is really impracticable, even if it is wholly desirable." (***)

Well—perhaps it is—but what truly worthy and great ideal is attainable?

I think it was Carl Schurz who compared ideals to the stars, our safe and sometimes only guide, to direct us on our way, not with the idea of attaining them, but, by shaping our course, thru their guidance we achieve our destiny.

Mr. Brander Matthews' given reasons why a phonetic system is impracticable, and perhaps undesirable, are two. First, the ever changing nature of our spoken language; and second; at any given time there is no fixt standard of pronunciation. Each locality, yes every individual, having an undoubted right to, and does, willy-nilly, cast its and his influence in one direction, or an other, in varying and establishing, the only possible standard—usage.

In our jargon, we would say, pronunciation is a function of both time and position.

That is true, but,—mark you—as the pronunciation changes in time, the equally mobile system of phonetic writing would allow the written word to change with it. There might, of course, be a perceptable lag between the written and the spoken language, but the power factor need never be far from unity.

The very correspondence between the written and the spoken language would tend towards the stability of both.

The second objection is, of more immediate significance,—pronunciation as a function of position or locality. Does that so militate against the introduction of a purely phonetic system, as to make its discussion, one of theoretical interest only, an academic question of no practical value? Don't let us forget what Schurz said of ideals and the stars.

It is true, there is no fixt or absolutely authoritative standard of pronunciation, but, is not any one of us, who uses a dictionary at all, willing, tentatively, to accept the preference of any good modern standard lexicon. I think there are few, of us, who would willfully depart in pronunciation from those artificial standards, now based on a consensus of usage of the best speakers and writers, men who value language for its beauty, as well as strength. Don't let us quibble about what we mean by "best," you know as well as I.

At any rate, there are artificial standards, justly claiming a kind of authority in pronunciation, to accept any one of which for a phonetic system of writing, would certainly bring our written language much nearer to our actual speech, than is our present system; with its silent letters, like mutes in a chorus, its equivocal phonetics, and senseless idographs.

Let us suppose, for the sake of argument, that all the English-speaking world, were as interested, and as anxious, as some of us are, to see the introduction of a purely phonetic system, and were willing, for a short time, to undergo the hardships of accustoming themselves to the new system, and let us suppose, (which is quite within the limits of possibility) that our authoritative lexicographers had got together, and establisht a consensus of opinion, among themselves, as to the preferable pronunciation of every word, listed in the dictionary; and representing each, by its suitable symbols in the "Scientific Alfabet;" would there then be any further insurmountable difficulty to hinder the introduction and perpetuation of the phonetic system? Evidently there would be none. It is true, that the varied pronunciations, which each individual had inherited, or acquired from his environment, would cling to him, but he would spell, not according to that, but, according to what the accepted standard taught him, which, at least for most of us, would correspond more closely to our spoken words, than does our present system, and correspond more nearly to our ideal of good usage. And would not the very consciousness of the accuracy, and reliability, of the written symbols, as representing a proper pronunciation, direct our speech toward uniformity and precision in pronunciation?

But what have we proved, from this impossible supposition, of inspiring the whole English speaking world with an ideal? Just this,—that, in itself, there is nothing absurd nor impossible in a phonetic system. If I could use it, you could use it, if you could use it, we could use it, if we could use it, then, why not also they?

Yes,—Why not they also?

The form which our argument has taken is just the reverse of that used for popular exposition. We have begun by showing, that, at least the theoretical possibility, of a universal phonetic system of spelling, is not absurd. The popular argument begins by showing the perplexities and absurdities, of our present unsystem, and the enormous loss it entails, however we may measure it, in—time—effort—or money. That is so easy, and has been done so often, and so ably, is, in fact, to every reasonable individual so evident, that I hate to do it.

Let it suffice to assume, that, on the whole, our present method of spelling is unsatisfactory, wasteful and absurd, and should if possible be amended. This assumed, let us consider, from our point of view, just one of the objections raised against the proposed conservative changes leading in the direction of simplicity and more nearly accurate phonetics.

(*) There are, of course, finer distinctions to be drawn. For this purpose where desirable or necessary a diacritic may be used. It is not any particular system to which we are directing our attention, but only to the general principle involved. It has been suggested for general use to confine the employment of diacritical marks to long e and long i. A description of the Scientific Alfabet is to be found in the Standard Dictionary.

(**) The writer is indebted for some suggestions to an article by Ben E. Lyster, entitled "Commerce and The Spelling Reform," where it is pointed out that the "Scientific Alfabet" is, in principle, essentially the same as that which our stenographers are accustomed to, and daily use, for thousand upon thousand of letters in the business world.

(***) "The Spelling of Yesterday and the Spelling of To-morrow." Circular No. 4 of Simplified Spelling Board by Brander Matthews D.C.L.

What ever its value may be as an argument, I presume the most tenacious, the most inbred, objection which is ever raised, by the great mass of people, against any, so called, arbitrary change at all, is that of derivation, and the authority of usage.

The reason is, I think, not far to seek. We all know the imperative,—Why? of a child requires an answer "to save our face," and, I think, most of us who have tried to learn to spell have often questioned, why this, or that absurdity. Well,—what was the ever ready answer? Was it not either, root deriviation, or dogmatic authority of usage, and so each generation has grown up to accept these principles as final, and lexicographers have so recorded.

Have we not here set up a false standard for ourselves? True, the reason why we spell as we do, is largely derivation and usage, but is that sufficient reason why we should fall down and worship, as tho there lay our only salvation from chaos? Evidently no. Let not the past be our master, let our mind direct our destiny. The necessity of our existence firmly roots us in the ages gone, but the root is not the flower and fruit. Let us rather, like the plant, turning towards the light, reach out towards the possibilities of the future, drawing the material, but not the form nor structure, from such sources as the past provides.

What can we do? What should we do? What is possible and what is impossible, to be done, in this matter of ameliorating our absurd, false and defective system of spelling?

Nature works by evolution; man cannot successfully oppose the laws of nature. Have we gone too far in the wrong direction?

Can the intelligent effort of the few, swerve this mighty mass, change the direction of the accumulated momentum of centuries? We know the answer in mechanics. It can be done. To oppose,—that were futile, we should be crusht. To direct,—that is possible. Little by little, almost unnoticed perhaps, by the many, the simplier forms of spelling will find their way into common use. Here, each individual may do his part, take one word, take two words, take three words, take three hundred if you will,—use them—use them—use them. If we write, at all, we cannot remain entirely passive, every written word, more justly spelled, leads this way, every false one that. It lies with us to choose.

Preservation of Line Poles.

At the recent meeting of the Ohio Independent Telephone Association, Mr. H. P. Folsom presented an interesting paper entitled "The Sterilization and Preservation of Telephone and Telegraph Poles." It was pointed out that there were in 1902 in this country 750,000 miles of telegraph and telephone pole lines, which at the rate of 37 poles to the mile corresponds to 27,750,000 poles; and estimating the electric light and railway poles at 5,000,000, there were 32,750,000 poles in 1902, or probably 40,000,000 at the present time. At an average cost of $5 per pole, these represent $200,000,000. The Bell Telephone Company alone used over 500,000 poles in one year to replace old ones, and the question as to how in the future pole lines are to be maintained is a vital one. Moreover, the same problem exists with respect to railroad ties.

It has been proved beyond question that the decay which takes place at or near the soil line of the post or pole, is caused primarily by living organisms, namely, bacteria or fungi, and in some rare instances by insects. Bacteria and fungi are both low forms of life; they multiply when once they attack a pole with great rapidity, and since their action on the fiber of the wood is practically the same, they will be considered in this paper together. They attack either dead or living timber; on dead timber they attack the walls of the cells and the result is the familiar decay or rot under consideration. If the life of the pole from the surface of the ground up and down a few inches can be prolonged from ten to twenty years, it will add millions of dollars to the value of our telephone plants; and the stocks and bonds of all companies that use poles in their construction will be vastly increased in value.

The paper is largely devoted to an account of experiments made by Mr. Folsom and his associates during the past seven years, though some of the experiments have extended over a period of nearly twenty years.

It having been demonstrated by a long line of experiments that the cause of decay at the ground line was a bacteria and fungus growth induced by a certain amount of moisture and heat from the sun, and that in order to sterilize and save the life of the pole, an antiseptic must be used that would penetrate the pores of the wood. A class of poles was selected that had been in the ground for about eight years and which was thoroughly infected with germs; indeed some of the poles experimented upon were over half rotted through and would not have lasted two years under the most favorable conditions, and were so weak that they would not have survived a severe storm at all. The pole was dug around about 18 inches and a pointed instrument used to scrape out and away all the rotted wood. The antiseptic chemicals were then applied with a trowel, filling all the holes and depressions even with the surface of the pole. Next there was placed around the pole an especially constructed jacket made of pliable and especially prepared asbestos that would resist the action of the elements, such as rain, snow, freezing and thawing. The poles were filled in around with the antiseptic material to the top of the jacket in the space between it and the pole. The top was in some instances allowed to remain open so that it received all the rain and snow that fell and which might run down the pole. In others a cap was placed over the top of the jacket. Care was taken in mixing the antiseptics to use none that would cause the pole to become brittle and thus weaken it. It was found that in all instances after a period of over six years, the antiseptics had completely sterilized the poles where applied, and the decay was entirely arrested. In fact, the poles were in as good condition as when the treatment was first applied. The experiments were then extended to a class of poles that had not been in the ground more than two or three years; the surface indications showed only slight infection, but the sappy portion had begun to scale and the cracks exhibited unmistakable signs of decay. No attempt was made to clean off the decayed portion of this class of poles, which were treated by placing the jacket around the pole and depositing between it and the jacket the antiseptics and then sealing and fastening the collar above referred to. The jacket on these poles was about 18 inches wide, extending below the ground about 14 inches, and above the ground about four inches. Upon examination of this class of poles nearly six years after treatment, they were completely sterilized and free from the effects of the bacteria and fungi. There was no evidence of them under a powerful microscope.

The paper gives some figures as to the cost of sterilizing poles. Assuming 5000 poles costing $5 each, in the ground fully equipped, their original cost would be..... $25,000

At the end of 12 years they will have to be renewed at a cost of.....	25,000
Interest for 12 years on the last $25,000.....	18,000
Making a total cost for 24 years of.....	$68,000

STERILIZED POLES.

Original cost of 5000 poles.....	$25,000
Cost of sterilizing after they have been in the ground two years, $1.25 each.....	6,250
Interest on this amount for 22 years.....	8,250
Making a total cost for 24 years.....	$39,500
Cost of 24 years without treatment.....	$68,000
Cost of 24 years with treatment.....	39,500
Profit in favor of treatment.....	$28,500

The paper does not state what antiseptics are used in the process.

New Telephone Patents.

NEW APPARATUS.

C. A. L'Hommedieu, of Buffalo, N. Y., has suggested a desk set with the auxiliary apparatus included in its base. The stem of the stand forms a support for a single gong, the contour of which conforms with the curves of the base. The clapper is within the gong and its rod leads down to the ringer in the base.

With telephone apparatus for the partly deaf, the convenient attachment of the battery becomes a problem. Mr. L. F. Clark, of Boston, has arranged a battery to slip in the jacket, its terminals being a twin plug. A pair of sockets upon the back of the transmitter register with this so that the transmitter is supported and yet may be attached and removed at will without the use of tools, screws or clamps.

SWITCHBOARD IMPROVEMENTS.

The divided multiple has heretofore been resorted to in order to increase the operating limit of the unit exchange. Two general methods have been used. In the one, each line has a calling apparatus on each division of the switchboard, and he can at will select the division at which at any time he will throw his signal. With the other plan, each line has but one signal, and any calls for numbers not on its own division are trunked to the proper division just as though to another exchange.

E. E. Clement now brings out a sort of compromise system. Here each line has but one signal, and the sole duty of the responding operator is the connection of an idle trunk to the calling line. The trunk has a calling signal at each division and the subscriber can determine which trunk signal will show, thereby obtaining attention at the proper division.

A private branch exchange trunk forms the subject of a patent to W. W. Dean, assigned by him to the Kellogg Switchboard and Supply Company. This is a two-way trunk with a plug at the private branch end and a jack at the exchange end, the exchange end being worked out for the Kellogg Company's two-wire system. The circuit provides double-end calling, supervisory and disconnect signals.

A NEW REPEATER.

Mr. C. Newman, of Elizabeth, N. J., has applied a peculiar action of the phonograph as a means to a repeater. Mr. Newman attaches a cutting stylus to his receiving part, and uses up the received energy in vibrating the stylus. He finds that the rotating cylinder amplifies the motion of the stylus by its mechanical reaction, the amplified vibration being practically a counterpart of that received. This is the means of introducing new energy for the retransmission, as the movable electrode of the repeater transmitter is secured to the stylus rod.

PARTY SYSTEMS.

A party line step-by-step system has been patented by J. A. Hulit, of Topeka, Kans., which embraces a rather novel feature of selection. A succession of long dashes such as used in the Morse code, with short intervals between, serve to advance the switching mechanism, while a long space allows its return to normal or zero position. This applies to all stations, the switches working synchronously. This action is accomplished by a slowly-moving release lever which in the long space falls sufficiently to trip a retaining pawl.

Another scheme for party lines, the invention of K. Kohn, of New York City, is a selective system controlled by electromechanical switches. The call is affected by different combinations of current applied to the line wires in a particular way. These currents act on various direct switches of the circuits of all stations so that a selection is effected at the desired station and all others are excluded.

RECEIVER SUPPORTS.

M. H. Black, of Pittsburg, has patented a receiver support for telephones, in which a clamp placed about the transmitter body supports a swinging telescoping arm, the end of which carries a receiver clamping piece. The height of the clamp above the horizontal plane of the transmitter is adjustable.

Another support, this to be clamped to the transmitter arm, is patented by D. G. Hobby, of Albion, N. Y. In this the arm which carries the receiver clamp is hinged to move in a vertical plane so that the receiver may be thrown up out of the way when not in use. A linkage connected with this arm drops a weight into the hook switch prongs when the arm is up.

Letter to the Editors.

N. E. L. A. Trade Exhibitions.

To the Editors of Electrical World:

Sirs: A valuable feature of the conventions of the National Electric Light Association has been the exhibits of the electric lighting apparatus, appliances and material. In the earlier years of the association the exhibits furnished the main attraction of the convention, and while this was partly or even largely due to the rapid course of electrical evolution in that period, the falling off of interest cannot be entirely accounted for by lack of novelty in present-day electrical development. It is, of course, not desirable to have the convention proper overshadowed by its trade feature, but so long as the latter is continued the maximum benefit should be derived from it, which has not been the case in recent years.

The reason for the uneven character of N. E. L. A. trade exhibitions most probably lies in the faulty method by which they are organized and conducted, dependence being placed on a committee, changed each year, with the result that occasionally the exhibition is a failure, which naturally reflects on the association as a whole. A remedy for this situation is not far to seek, for the same condition has at some period in their history been presented to similar bodies and a proper solution found. I refer particularly to the Manufacturers' Associations affiliated with the Master Mechanics', Car Builders and American Street and Interurban Railway Associations. These bodies are regularly organized with constitutions and by-laws for the purpose—to quote from the constitution of the last-mentioned—of "providing for and having custody of such exhibits of material as may be made at the annual conventions." The predominant membership of the bodies consists of manufacturers—in other words, of those who furnish the exhibits; and these affiliated organizations not only relieve the main organization of all care as to the exhibit feature of conventions, but to a great extent assume its entertainment expenses.

A particular advantage of this arrangement is that it obviates friction and ill feeling between the national industrial body and manufacturers on the score of exhibit assignments and charges; any issues such as these, which are moreover less likely to arise when manufacturers through their organization control expenditures and allotments, are likely to be amicably settled among themselves by business men, and in any event will not embroil the main body. Another great advantage is that the members of the affiliated bodies have a personal as well as business interest in making a success of the annual convention; and as the body is organized solely for exhibition purpose, and naturally works through an expert staff, it can readily be seen how much more efficient are exhibitions under its auspices than under the auspices of the usual exhibit committee appointed annually by other national industrial associations, to which the trade exhibit is merely a side issue, and often the cause of friction with manufacturers and of other trouble. In the case of the N. E. L. A., an arrangement might be possible whereby the Co-operative Electrical Development Association would relieve the association of at least part of the details relating to the exhibit feature of conventions.

New York. Chas. L. Jameson.

DIGEST OF CURRENT ELECTRICAL LITERATURE

Dynamos, Motors and Transformers.

Design of Alternators as Influenced by Rated Speed.—H. M. HOBART AND H. E. ELLIS.—The great difficulties encountered in the design and construction of direct-current generators for steam-turbine speeds have led to the realization that such speeds are very unfavorable to direct-current generators. On the other hand, since the commutation problem is absent in ordinary alternating-current generators, it has been concluded that the higher the speed the more economical will be the design and the better its quality. In the present serial the authors endeavor to prove that this is wrong and that on the contrary for a given rated output there is a certain rated speed which is most favorable to the design as regards both economy and quality. In the first article the authors discuss machines of fairly-small-rated output and, as an example, they consider the case of a 400-kilovolt-ampere three-phase 50-cycle alternator. They compare three designs designated in Fig. 1 as A, B and C. The terminal voltage is 3000 in A, 3000 in B, and 550 in C, the speed in r. p. m. is 94 for A, 1500 for B, and 3000 for C. The number of poles is 64 for A, 4 for B, and 2 for C. The dimensions of the three designs are given in a table and the influence of the rated speed on the principal properties is discussed especially with regard to losses and efficiency, pressure regulation, weight and cost. The authors conclude that both the weight and the cost reach a minimum at a speed of 1500 r. p. m. for a 50-cycle machine. The two pole 3000 r. p. m. machine, although of double the speed, has considerably greater weight and cost than the four-pole 1500 r. p. m. The authors then discuss the drawbacks of the two-pole design and conclude that two-pole machines have not only inferior electrical qualities, but also are difficult in mechanical construction and ventilation and are not to be preferred to designs of four poles at slower speeds. For small-rated outputs four-pole designs are quite favorable, and for large rated outputs it may be found that six poles or eight poles are more suitable. The performance of bipolar alternators may, however, be improved by the application of some of the more simple compensating devices like those of Walker and Heyland. In Fig. 1 there is designated as D a rotating-armature design for 3000 r. p. m. and two poles, as an alternative to the rotating-field design C. The principal difficulty in connection with the two-pole design relates to the limited field-winding space. Since the field-ampere turns are several times the armature ampere-turns it would seem rational to use as the armature the rotating element, on which the winding space is very restricted. Such a design is outlined in D, there being shown two types of frame, the one circular and the other rectangular. There is an abundance of room for the armature copper. A further improvement rendered possible by the use of a rotating-armature design is that the lengths of the magnetic paths in the poles and yoke are much greater, and a higher degree of saturation may be obtained. Another chief advantage of the rotating-armature design lies in the large reduction in weight of armature laminations, and consequently armature core loss and heating. A larger amount of material is, of course, required in the field system, so that the total weight and cost of effective material come out rather greater for the rotating-armature design. This is offset by its better electrical quality and further by the fact that the total weight is considerably less, as no stator frame is required in the case of the rotating-armature machine.—Lond. *Elec. Eng'ing*, May 2.

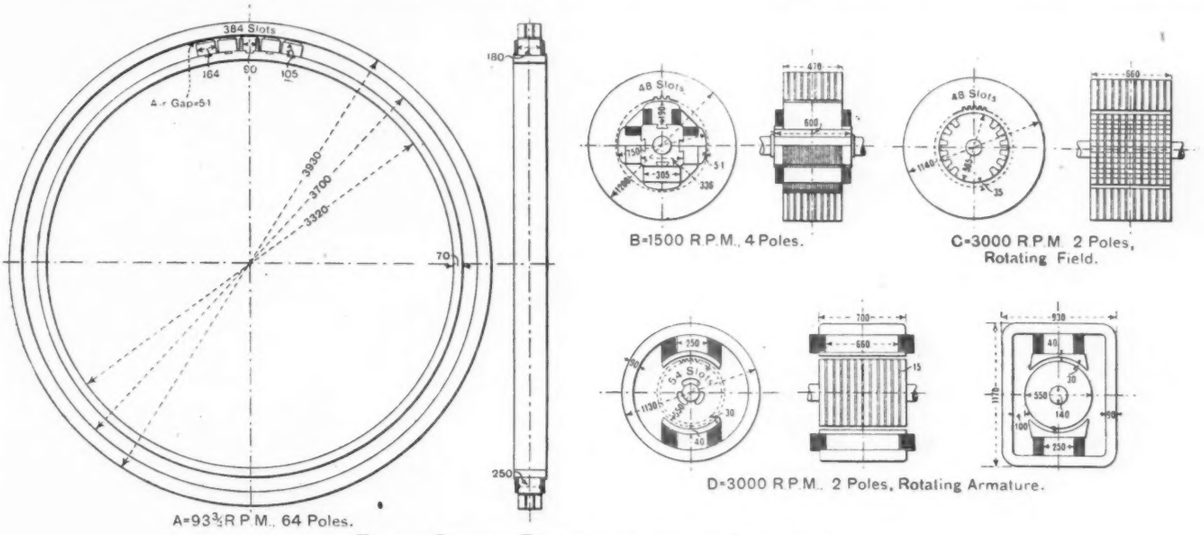


FIG. 1.—OUTLINE DRAWINGS OF 400-KW ALTERNATORS.

Commutation.—M. WALKER AND J. N. DODD.—A paper by M. Walker read before the Engineers' Club of Manchester on problems in commutation, being primarily intended for beginners. The author points out the necessity of having good contact between brush and commutator and the mechanical difficulty in obtaining it. He then shows the electric difficulties connected with commutation and explains the advantage of high resistance brushes, brush shifting, a strong field, low permeability in the pole corners, commutating poles and short-chord winding. The paper closes with a list of causes to be looked for if a machine fails to commutate perfectly. In an editorial, J. N. Dodd comments on two points in the paper. One is the reference to the inductor effect, where sparking is caused by the change in the number of teeth under a pole. This change in magnetic permeability will cause a change in the voltage of the machine. The amount of this change, however, will be slight and it will be of such high frequency that it cannot be noticed. The flux from the poles is surrounded by the coil undergoing commutation. The change in flux will set up an alternating voltage in the short-circuited coil. This alternating voltage might be sufficient to cause poor commutation, but we would be more apt to look for the trouble as due to another cause; if the number of slots under the pole is so small as to cause a change in the magnetic permeability of the circuit, there is probably a great number of coils in each

slot and a very small number of slots in the neutral space. Consequently each coil will be commutated in a different magnetic position, some in a very weak reversing field and some in a very strong reversing field. Good commutation would, in this case, be impossible and would be helped only by the remedy Walker gives, namely, beveling the poles so as to give a more even magnetic fringe. The second point commented on by Dodd is the strength of the main field with reference to the armature. Walker says the main field should have from two to two and one-half times as many ampere-turns as the armature. Most American engineers seem to consider that while there are some good reasons for employing such a strong field, it is, in general, stronger than necessary. Practically all designers, however, stick religiously to the rule that the field ampere-turns must exceed the armature ampere-turns by at least a certain percentage and the stronger the field the better are the commutating conditions. Neglect of this rule very generally brings a man into trouble, and yet practically every designer will admit that, in theory, it is wrong. It mistakes a cause for an effect. As the current flows in the armature coils it causes a flux around the coil. It is the cutting of this flux by the commutated coil that causes the trouble in commutation. True the flux is caused by the armature turns, but it is the flux and not the ampere-turns which cause a machine to spark. This flux is annulled by the flux from the field. This field flux is caused by ampere-turns, but it is the field flux, not ampere-turns, which annuls the trouble. It should be possible to design a machine with a small number of field ampere-turns and at the same time with the air-gap and pole face arranged to give a field flux distribution that will annul the armature flux as perfectly as is done in the ordinary machines. That

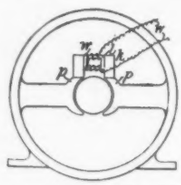


FIG. 2.—FIELD MAGNETS.

the ratio of armature ampere-turns to field ampere-turns is not a dominant factor is shown by the fact that some machines may be made to commutate better by decreasing the air-gap or lengthening the pole horns, thus decreasing the field ampere-turns.—*Electric Jour.*, May.

Field Magnets.—A note on a recent patent of C. A. Parsons and A. H. Law on a modification of field magnets of dynamos. The arrangement is shown in Fig. 2. An adjustable leakage path, consisting of magnetic material excited by alternating current varying with the load on a dynamo-electric machine, is provided between the magnetic poles to regulate the voltage output. The poles, *pp*, are provided with projections *k*, between which is situated the leakage path, *l*, carrying a winding *w*, energized by an adjustable alternating current. "The alternating excitation superimposed upon the continuous flux lessens the permeability of the magnetic path, so that the leakage is diminished when an alternating current is passed through the winding. The leakage path may consist of a laminated iron ring or series of rings, concentric with the armature and energized by an alternating current, or of one or more separately-wound bars connecting projections on the pole-pieces. The leakage path may be provided with an air-gap for adjustment to different working conditions."—Lond. *Elec. Eng.*, April 12.

Induction Motors.—An account of the discussion which followed the recent paper of L. J. Hunt on his new induction motor which is essentially an application of the cascade system. M. B. Field criticized the author's design and deductions, pointing out the weaknesses of all cascade systems of control, and suggested that the proper solution of the problem lay in some form of mechanical change-speed gear.—Lond. *Elec. Eng'ing*, April 11.

Lamps and Lighting.

Flame Arc.—In a recent patent of the British Thomson-Houston Company it is proposed to use as principal constituent of the arc electrode a refractory conducting substance, such as a metallic oxide, to which is added a fluoride or phosphate or a mixture of fluoride and oxide of an alkaline earth metal. For instance, the electrode may be formed of from 83 to 85 per cent magnetic oxide of iron, the remainder being substantially equal parts of calcium oxide and calcium fluoride. Or the chief constituent may be a mixture containing about 62 per cent of magnetic oxide of iron, 27 per cent of titanium oxide and 11 per cent of chromite; this represents the chief refractory constituent forming from 83 to 85 per cent of the total electrode, the remainder being a mixture of calcium oxide and calcium fluoride. In either case the light-producing addition may be replaced by calcium phosphate. The advantages of such electrodes are that they have a long life. The light contains a considerable proportion of red and yellow rays.—Lond. *Elec. Eng'ing*, April 11.

Arc Lamp Carbon.—An account of a recent British patent granted to Siemens & Co., of Berlin. Metallic insertions are frequently introduced into electrodes for arc lamps for the purpose of diminishing the resistance of the electrodes. The present invention consists of the introduction into the carbon of a metallic insertion in the form of a woven or netted tube. The meshes of this netted tube are filled as completely as possible with conducting carbon cement or with a material of which electrode cores are made. Copper is particularly suitable as metal for the insertions made. Such electrodes are said to burn excellently with a high current and to be particularly suitable for signal lamps on account of the great steadiness of the arc. When used with alternating current they have the advantage that the noises produced with other carbons at high current strength practically disappear.—Lond. *Elec. Eng'ing*, April 11.

Tungsten Lamps.—A note on a patent of the British Thomson-Houston Company for the manufacture of "incandescent bodies" for electric lamps from tungsten compounds. Nitrogen compounds of tungsten are manufactured from the trioxide, and one or more of these compounds are mixed with a binding material and squirted into filament-shaped threads. They are baked to carbonize the binder, and then heated electrically to decompose the nitrogen compound into tungsten and the other component elements, which latter are finally volatilized.—Lond. *Elec. Eng'ing*, May 2.

Hissing Point of the Metallic Arc.—W. G. Cady.—An abstract of an American Physical Society paper giving a preliminary report on the arc between iron and copper terminals. The so-called iron arc is, in air, an arc between molten globules of magnetic oxide of iron. Observations were first made to verify the generally accepted linear equation $E = a + b\,l$ connecting the volts across the arc with the length of the arc for iron electrodes. When curves were drawn showing the potential drop as a function of the length for different currents, it was found that the curves had approximately a parabolic form, suggesting that the equation should have a term involving Vl. The difficulty encountered in getting reliable results in the neighborhood of one ampere led to the detection of an abrupt change in the iron arc analogous to the hissing point of the carbon arc. Experiments showed that the effect is confined mainly to the anode. With copper electrodes the hissing point can also be found. It occurs with electrodes 6 mm thick, when the current is about 0.5 amp., with about 110 volts across the arc.—*Phys. Review*, April.

Power.

Hydro-Electric Power Versus Steam.—H. von Schon.—The first of two articles of a serial on hydro-electric power versus steam for industrial plants. The author first examines the comparative claims of fuel versus water power, their initial sources, their availability, efficiency and cost, and then discusses the factors which have to be taken into account in the development of a water power as a commercial enterprise.—*Eng'ing Magazine*, April and May.

Traction.

Single-Phase Traction on Swedish Railways.—It is expected

that the introduction of electric traction on a large scale will soon become an accomplished fact in Sweden. There have not only been continuous experiments on a small line from Stockholm to Järfva, but the state has also spent more than $1,250,000 in buying water falls. The project which was worked out by R. Dahlander, comprises the electrification of almost the entire state railways of the whole southern half of Sweden beginning in Bollnäs. The power will be derived from five different water falls, and the total length of the lines is not less than 2000 km (1200 miles). The single-phase system is to be used.—From *Zeit. d. Ver. Deutsch. Eisenb. Verw.*, v. 47, p. 403, abstracted in *Elek. Zeit.*, May 2.

Single-Phase Traction in Italy.—The administration of the Province of Parma has decided to operate the line from Parma to Fornovo and from Stravella to Marzolara with single-phase current, the length being about 42 kilometers. Outside of the city the voltage will be 4000 and within the city of Parma 400. The frequency will be 25. The speed will be up to 30 kilometers per hour. The rolling stock will consist of 10 motor cars, each with two 60-hp motors, and 8 motor cars, each with one 60-hp motor and a number of trailers. The line will be equipped by the Italian Siemens-Schuckert Company, which will also supply four motor cars for the Roma-Civita-Castellana line. The electric equipment of each car of the latter line consists of four single-phase motors, each of 35 horse-power. The voltage on the trolley wire is 6000 outside of the city and 600 in Rome, the frequency being 25. A speed up to 35 kilometers per hour will be used.—*Elek. Zeit.*, May 2.

Railway Engineering.—F. W. CARTER.—An illustrated paper read before the Rugby Engineering Society on some problems in electric railway engineering. The author first deals with the calculation of rheostat resistance for direct-current railway motors and gives curves which enable the results to be obtained quickly. He then explains a method of calculating the energy consumption from dynamical principles. When a speed-time curve for a run with a given train is available, but not the corresponding input to the motors, it is often possible to form a very good estimate of the energy consumption by deducing the output of the motors and then, from the mean efficiency, obtaining the input.—Lond. *Elec. Rev.*, April 26.

Simplon Tunnel.—J. B. VAN BRUSSEL.—An illustrated article on electric traction in the Simplon Railway Tunnel by the three-phase system.—*Eng'ing Magazine*, April and May.

Installations, Systems and Appliances.

Municipal Versus Company Charges.—An anonymous communication calling attention to the case of a British town where, on the face of the audited accounts, the municipal lighting plant made large profits while its rates were decidedly lower than that of private corporations. But it is shown that if the accounts had been kept properly and all charges had been made accurately the municipal plant would have shown a loss instead of a profit.—Lond. *Elec.*, April 26.

Wires, Wiring and Conduits.

Resistivity Temperature Formulæ for Copper.—R. T. GLAZEBROOK AND M. KLOSS.—Two communications with respect to the recent article of Prof. Crocker. Glazebrook corrects some misprints in the exact formula and then agrees that the linear expression $R_t = R_0 (1 + a t)$ is sufficient for most purposes. He gives a table of the different values of a found by different investigators. It seems that the value of a depends to some extent on the exact treatment of the copper. The British Engineering Standards' Committee adopted Dewar and Fleming's value 0.00428, but Glazebrook agrees that Crocker's reasons for accepting a number somewhat lower, namely, 0.0042, have considerable weight. Kloss says that the coefficient 0.004, adopted in the German rules, refers to a mean air temperature which is always taken as 15 degrees C. The corresponding value for 0 degrees C. is 0.00426. The curve *VI* given by Crocker will now be of quite a different character and will lie slightly above the horizontal line *V*. Its formula can be given either as $R_t = R_0 (1 + 0.00426t)$ or $R_t = R_{15} (1 + 0.004 (t - 15))$.—Lond. *Elec.*, April 26.

Loss of Energy in Dielectrics.—B. MONASCH.—The conclusion of his article on energy loss in dielectrics of condensers and cables. The author found that the law that the loss is proportional to the square of the e. m. f. is strictly correct for all dielectrics which he tested and which included several kinds of glass, hard rubber, the dielectrics of the Grisson condenser plates, impregnated paper, rubber, impregnated jute. This square law is strictly correct as long as nothing but the voltage is changed. Apparent discrepancies from the square law occur when another quantity which also determines the loss, for instance, the temperature, is also changed. In glass and hard rubber the loss increases considerably even with small temperature rises in the dielectrics. But this discrepancy from the square law, due to the increase in the temperature of the dielectrics caused by the loss itself, was not observed in the cables tested up to the voltage of operation so that for the same the loss is exactly proportional to the square of the voltage. Another apparent discrepancy from the square law occurs if brush discharges take place. The energy loss in the dielectric is proportional to the capacity and may be considered as proportional to the frequency for the usual range of frequencies in cables. Since the square law is exactly correct there is no necessity of making tests with high voltages. With cables much more exact measurements can be made with short lengths of a few meters at 1100 to 1500 volts than has heretofore been possible with lengths of several hundred meters and at much higher voltages. Such a method appears to be quite suitable for commercial measurements of the losses and could replace the insulation test for alternating-current cables. The energy loss in the dielectrics in high tension cable net-works is by no means negligible. In short and medium lengths of cables it represents by far the largest part of the no-load loss, and it becomes less important than the Joulean heat loss only for very long continuous cables.—*Elek. u. Masch.*, April 28.

Electrophysics and Magnetism.

Rays of Positive Electricity.—J. J. THOMSON.—An account of an experimental investigation of Goldstein's "canal rays," or as the present author calls them, "positive rays." Since these rays seem the most promising subjects for investigating the nature of positive electricity, he has made a series of determinations of the values of the ratio of charge to mass for positive rays under different conditions. It appears that under very intense electric fields different substances give out particles charged with positive electricity and that these particles are independent of the nature of the gas from which they originate. These particles are of two kinds. For one kind the ratio of charge to mass has the value of 10,000, which is the same as for an atom of hydrogen in the electrolysis of solution. For the other kind the ratio of charge to mass has half this value; that is, it is the same value as for the alpha particles from radioactive substances.—*Phil. Mag.*, May.

Phosphorescence.—J. DEKOWALSKI.—Experiments of various scientists have demonstrated with increasing certitude that the difference between phosphorescene and fluorescence is only apparent and rather of a quantitative than of a qualitative nature. On the basis of the theory of electrons the present author tries to correlate these phenomena and to find an explanation which accounts for both of them on the same basis. He supposes the existence in every phosphorescent or fluorescent body of two kinds of systems of "corpuscules," endowed with different properties, and intimately united. To denote these systems he uses the terms electronogenous system and luminophorous system. An electronogenous system has the power of shooting out electrons when acted upon by light. A luminophorous system is a system of corpuscules whose internal energy is very near the critical value. Hence the absorption by it of even a relatively small quantity of electrons is sufficient to make it luminous. According to this hypothesis the phenomena of phosphorescence and fluorescence are explained as follows: In strongly electronogenous systems light produces the expulsion of electrons in considerable quantities. Now, as these electronogenous systems are intimately bound up with the luminophorous systems,

the secondary rays are able to penetrate into these latter, provided their velocity be in proper accord. The critical value of the internal energy of the luminophorous systems will soon be surpassed and light will result.—*Phil. Mag.*, May.

Constitution of Atom.—H. Pellat.—A paper presented before the French Academy of Sciences. The author shows that a flat atom cannot be stable and that the stable form of an atom is somewhat similar to the spherical form. The law of Coulomb must cease to be exact at very small distances of the order of magnitude of interatomic distances. The tractive force must increase less rapidly than the reciprocal of the square of the distance.—*L'Eclairage Elec.*, May 4.

Transmission of Roentgen Rays Through Metallic Sheets.—J. M. Adams.—An account of some experiments which appear to make it probable that the coefficients characteristic of the absorption of Roentgen rays in metallic sheets are all constant with varying intensity of the rays.—*Am. Journal of Science*, May.

Roentgen Rays.—J. M. Adams.—A note on a spectrum of the Roentgen rays from a focus tube, and relatively selective absorption of Roentgen rays in certain metals.—*Phil. Mag.*, May.

Polarization.—W. D. Harris.—An investigation of radiation and elliptic polarization produced by iron films in a magnetic field.—*Phys. Rev.*, April.

Condensers.—F. T. Trouton and S. Russ.—An account of an experimental investigation of the rate of recovery of residual charge in electric condensers, and the analogy of the phenomena involved with the recovery of elastic solids from overstrain.—*Phil. Mag.*, May.

Vectors and Wattful Currents.—C. Turnbull.—The writer proposes to indicate the direction and speed of a rotating vector by means of half-arrow-heads. The side on which the half-arrow is placed indicates the direction of rotation, while the number of half-arrows indicates the speed. What is otherwise called effective or useful current is called "wattful" current, being the converse of wattless.—Lond. *Elec.*, May 3.

Electrochemistry and Batteries.

Electrometallurgy.—J. B. C. Kershaw.—An article on the progress of the electrometallurgy of aluminum, calcium carbide, carborundum, copper, ferro alloys, graphite, iron and steel, nickel, tin and zinc during the last year. Nothing new is given.—*Cassier's Mag.*, May.

Units, Measurements and Instruments.

Insulation Resistance and Capacity.—J. Sahulka.—The first part of an article on the measurement of the insulation resistance and the capacity of the different conductors of alternating-current net-works during service. After a general introduction, the author discusses the distribution of the potential in a single-phase plant. The paper is to be continued.—*Elek. Zeit.*, May 2.

Induction Coils.—E. W. Ehnert.—The first part of an article giving a theory of induction coils suitable for predetermining their design.—*Elek. u. Masch.*, May 5.

Dynamometers.—P. Bayol.—An illustrated article on the calibration of the dynamometers used in submarine telegraphy.—*Jour. Telegraphique*, April 25.

Miscellaneous.

British Institution Electrical Engineers.—The next president will be Lord Kelvin.—*Lond. Elec.*, April 26.

Exhibition.—An illustrated description of various electrical exhibits at the Building Exhibition now open at Olympia, in London. Several time-switches, for instance, in connection with two rate meters, an electrolytic meter, dust-destructors, electric fire-alarm systems are described.—Lond. *Elec.*, April 19.

Experimental Mathematics.—Pochin.—An abstract of a (British) Physical Society paper. An instrument for drawing logarithmic spirals was exhibited and it was shown how the principal properties of logarithms and of the equi-angular spiral may be established as experimental results.—Lond. *Elec.*, April 19.

Uppenborn.—An account, by C. Paulus, of the life and work of the late Friedrich Uppenborn, with his portrait.—*Elek. Zeit.*, May 2.

BOOK REVIEW.

Schalttafelbau. By A. Boje. Hannover: Dr. Max Janecke. 184 pages, 100 illustrations. Price, 2.80 marks.

The construction of switchboards is a business by itself and the design of switchboards calls for considerable experience and knowledge. This little volume deals with the subject from the engineer's standpoint. The text is abundantly illustrated with diagrams and half-tone photographic representations of actual switchboards. The book will be useful to switchboard designers who desire to keep informed concerning German practice. It is divided into two sections, the first on generating-station switchboards, and the second on distributing-station switchboards. In both sections low-tension systems are mainly considered. The description is clear and easily followed. Arithmetic is used throughout and no algebra. There is a useful index of subjects considered.

Electrical Equipment of a Pulp and Paper Mill.

The power requirements of pulp and paper mills present many problems arising from conditions peculiar to this class of industries. Continuity of service and uniform speed are essential to the successful manufacture of paper as when a run of stock is started it must be continuous, and any lack of uniformity in speed seriously affects the quality of the product.

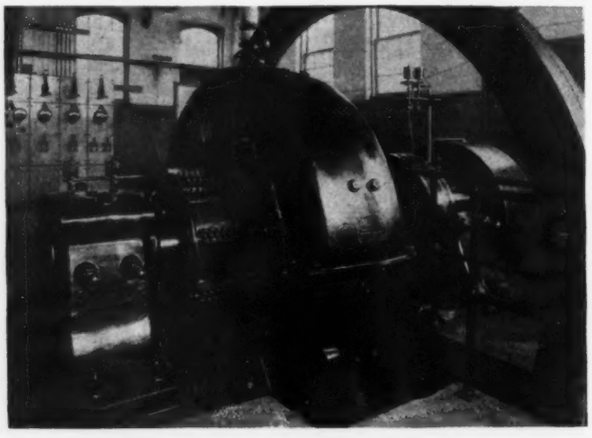


FIG. I.—VIEW OF ELECTRIC POWER ROOM.

The starting conditions of some of the machinery are severe and a large overload capacity in the motive power is therefore necessary.

Electric motors have been found to fulfil all these requirements and have been adopted to a large extent by pulp and paper manufacturers. Many advantages are derived from their use that to a large extent eliminate the objectionable features of mechanical transmission. Another important feature is that certain portions of paper machines that operate at variable speeds, including the wire, press rolls, dryers and machine rollers, and it is essential that the speed variations cover a considerable range, be easily controlled and complexity avoided as far as possible. In existing direct-current plants or mills where it is deemed advisable to install direct current motors the variable speed feature is taken care of by the use of shunt-wound motors, regulated by field control, which have a sufficient range to entirely eliminate the use of mechanical speed changing devices which are necessary where mechanical transmission of power is used.

An illustration of the foregoing remarks is found in the plant of the Grand Rapids Pulp & Paper Company, at Grand Rapids, Wis. The mills are located on the Wisconsin River about four miles from the town, where an abundance of water power is available. This company strongly advocates the use of electric drive and fully realizes the many advantages derived

from its use. The electrical equipment was laid out by Mr. V. D. Simons, general manager of the company, and installed under his direct supervision and there are many mechanical and electrical features of interest.

The pulp mill, where the stock is prepared for the manufacture of paper, is operated by water power but the various processes afterward carried on employ electric drive.

One of the essential conditions of paper making is that as

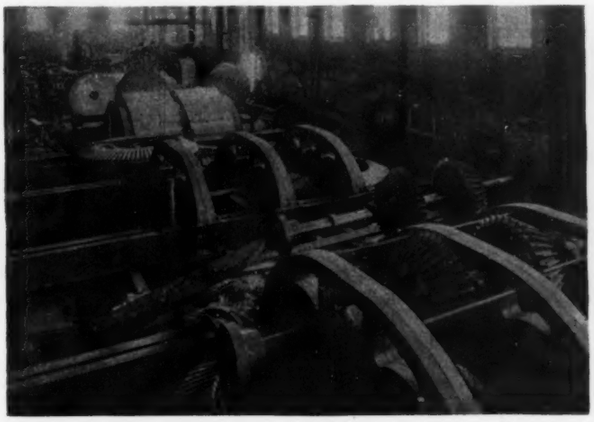


FIG. 2.—HYDRAULIC POWER ROOM, WHERE WOOD IS RECEIVED.

the weight or thickness changes, the speed must be easily altered to provide for changes in the rate of production—which is usually accomplished by mechanical means. In the present case, however, this result is accomplished by the use of variable-speed motors. There are two Beloit paper machines, the smaller of the two having an output of 21 tons per day, or 525 ft. per minute, the width of the paper being 84 inches before and 78 inches after trimming. There are 29 dryers and a 70-ft. wire. That portion of the machine which operates at variable speeds is driven by a 100-hp, shunt-wound motor with a speed variation of 470 to 750 r. p. m., which is obtained by field control. The actual power required, as shown by tests, to drive the variable speed portion of the machine under normal working conditions, is 101 hp. That portion of

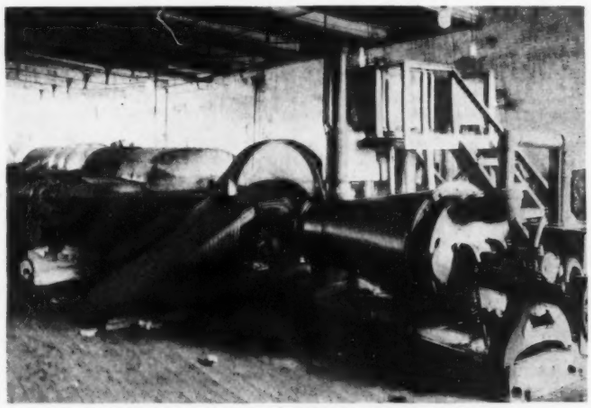


FIG. 3.—WOOD PULP BEATER ROOM.

the machine which operates at constant speed is driven by a 50-hp Westinghouse type S motor.

The larger machine has a capacity of 26 tons of paper per day at the rate of 475 feet per minute, 104 inches wide before and 97 inches after trimming, and is provided with 25 dryers and a 60-foot wire. The variable speed portion is driven by a shunt-wound motor with a speed variation ranging from 470 to 750 r. p. m., obtained by field control. Actual power determined by tests to drive the variable speed is 97 hp. The constant speed portion is driven by a 50-hp motor.

In the cutter room there are two cutters and an elevator operated by a 10-hp back-geared motor. A 10-hp motor driving a fully equipped machine-shop for general repair work completes the electrical equipment.

The generator equipment consists of one 200-kw, 220-volt, engine-type, direct-current generator, direct-connected to a Corliss engine, and one 150-kw generator of the same type belted through a countershaft to a water wheel. The latter generator operates in parallel with the engine-driven machine.

An interesting feature in the regulation of the water wheel is the arrangement for controlling the gates. They are

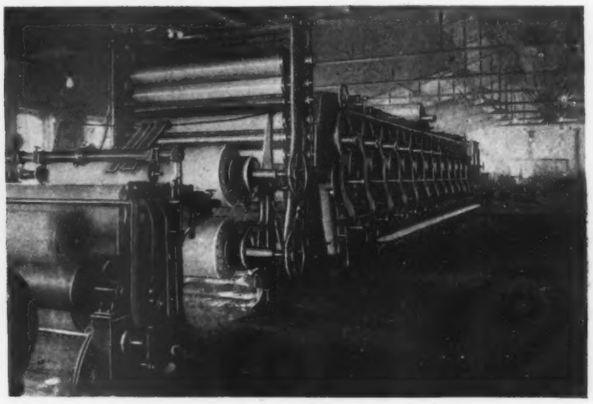


FIG. 4.—PAPER MACHINE ROOM.

operated by a series-wound reversible back-geared motor, started, stopped and reversed by means of a double push button on the switchboard. There is also an attachment on the governor of the engine for automatically controlling the motor, thus regulating the loads of the two generators.

All of the electrical equipment was supplied by the Westinghouse Electric & Manufacturing Company.

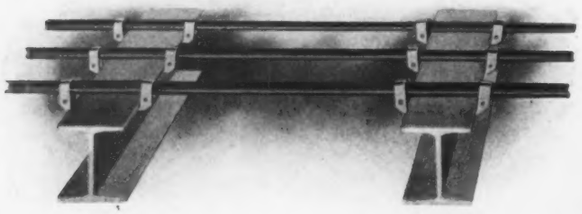
Electric Glue Pots in a Large Bookbindery.

An interesting feature of the large bookbindery of Messrs. Ginn & Company, of Boston, located at Cambridge, Mass., is the use of electric glue pots in the establishment. About fifty of these pots were in service in the plant at last accounts. These replaced a number of steam heated glue pots which were a continual source of annoyance, especially from leaking steam pipes. Before electric pots were installed the company had suffered considerable damage to its stock from time to time, by the moisture from leaky pipes, and in one instance the bursting of a steam pipe spoiled a large number of books. The requisite steam pressure was 100 lbs., and the installation was dirty and unsightly.

The pots installed in the plant for electric glue heating were supplied by the General Electric Company, a distinctive feature of the equipment being the absence of a water bath in the pot construction. The glue is melted quickly without danger of overheating it in case the current is left on too long; and the pots are placed beneath the tables of individual bookbinders and clamped in secure position against the legs. Each pot is a large, shallow receptacle of about 8 quarts capacity. The books, minus their covers, are stacked in small piles of about a dozen each, so that the glue may be applied to the backs of the entire pile by a brush at one time; and in this way from one to two thousand books a day can be glued by a single workman. After the books are glued, they are taken to a cover machine which automatically puts on the covers. It has been found very advantageous in the use of electric glue pots that the time and heat lost by workmen in carrying heated glue pots from place to place are eliminated. In the Ginn plant, the heads of the embossing presses are heated electrically instead of by steam, as in the old methods. Several General Electric 500-watt cartridge flat-iron units were inserted in holes drilled in the heads of these embossing machines, and connected to the supply circuit through a suitable controlling switch. The results have been much more satisfactory than with steam coils.

Conduit Clamps.

A form of conduit clamp recently placed on the market by Pass & Seymour, Solvay, N. Y., is indicated in the accompanying illustration, where several clamps are shown holding iron pipe conduit in place against a steel girder. It is claimed that



CONDUIT CLAMPS.

the clamps are neat, compact, of sufficient strength, very reasonable in price, and easy to install, a screw-driver being the only tool required.

Central Energy Automatic Telephone System.

In the automatic telephone system developed by the American Automatic Telephone Company, Rochester, N. Y., not only is all of the energy for operation supplied from the central station, but, with the exception of the sub-station selector, no mechanical equipment is located outside of the central office. Only two wires are employed in the subscribers' circuit, and no use is made of the ground for selective purposes. The scheme for calling is known as the hyphenated-number system, either single or double numbers being transmitted at one time as desired.

In the particular system here illustrated and described the calling is accomplished by two motions of a 50-point dial by means of which it is possible to select any one of 2500 subscribers; with three motions of a similar dial, and proper central station equipment, the subscribers could be increased in number to 125,000. At the central station the subscribers' terminals are arranged in 50 groups, each group representing 50 subscribers. The first movement of the caller's dial selects the desired group, while the second selects the proper subscriber in that group.

When a calling subscriber removes the receiver from the

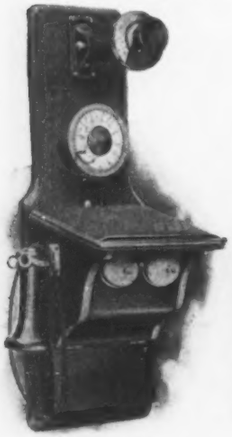


FIG. 1.—SUB-STATION SELECTOR ON WALL SET.

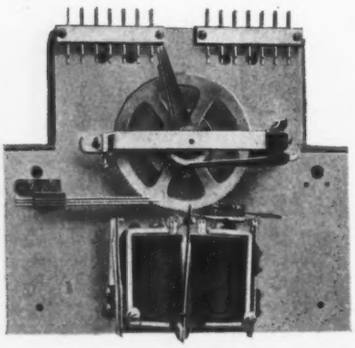


FIG. 2.—MAGNETICALLY DRIVEN SELECTOR SWITCH.

hook, the circuit from the central station is closed through the springs of the calling station selector, thereby energizing a relay at the central station which serves to connect the calling subscribers' line to an "idle" inter-connecting circuit. When the calling subscriber rotates the dial, the circuit at his station is opened as many times as the number pulled on the dial which may be from 1 to 50. Thus there would be selected a trunk corresponding to a certain group of 50 subscribers. The second movement of the dial locates the desired called subscriber in practically the same manner as the calling subscriber's line was connected initially to the idle circuit. When a subscriber has completed the conversation and hangs up the receiver the circuit at his station is completely opened, and certain

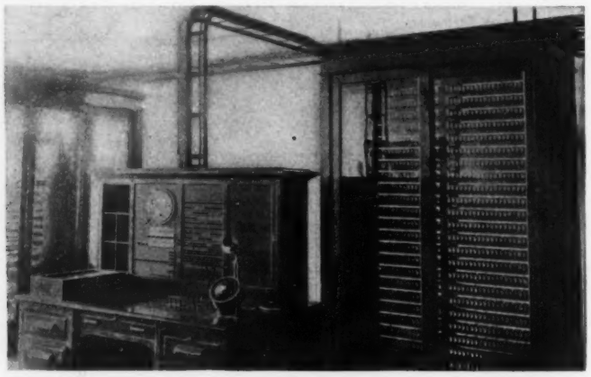


FIG. 3.—RELAY RACK AND WIRE-CHIEF'S DESK, IRONTON EXCHANGE.

relays at the central station make back contacts and restore all switches to their "idle" position.

The first application of the above system was in the Ellis Hospital, Schenectady, N. Y., which was soon followed by a system in the Eastman Kodak Works, Rochester, N. Y. The latest application is the exchange of the Home Telephone Company, Ironton, Ohio, which is equipped for four hundred direct lines and one hundred four-party lines, making a total of eight hundred telephones.

Construction of the Northern Milwaukee Railway.

Progress has been made during the fall and winter months on the construction work of the Milwaukee Northern Railway, which will soon open up communication between the Eastern Wisconsin towns of Sheboygan, Port Washington, Fond du Lac, West Bend and Milwaukee. The district thus thrown open is extensive, rich and populous; but up to the present time has been practically isolated from the Wisconsin metropolis because of meager transportation facilities. Milwaukee merchants will be placed in touch with 100,000 people, through its agency. Except for short distances in the centers of some of the larger towns, the Milwaukee Northern roadbed is located on its own right of way, and in almost a straight line. There is practically but one curve on the line, between Port Washington and Grafton and that is one of only 2 degrees. For the rest of the distance almost without variation, except where the road crosses the tracks of the C., M. & St. P. and the C. & N. W. railroads, the right of way follows a straight line. The entire absence of grade crossings is a feature which goes far to insure safety from accident and permits of a high speed schedule.

The complete power equipment was purchased from and built by the Allis-Chalmers Company, of Milwaukee, and is of standard Allis-Chalmers design, both for gas engines and alternators. The electrical features of the equipment may be briefly described as follows: three-phase alternating current will be generated in the power house at 405 volts, by three direct connected alternators each of 1000 kw normal capacity, driven at 107 r. p. m. by twin tandem gas engines, each with a rated capacity of 1500 hp. This equipment when in operation will enjoy the distinction of being the largest installation in America of gas engine driven electric generating units for traction purposes.

The main power house is located at Port Washington, and sites for sub-stations have been provided at the following points: Burleigh, Cedarburg, Georgia Avenue, Marblehead, Brown Deer, Cedar Grove, West Bend and Campbellsport.

Industrial and Commercial News

Commercial Intelligence.

THE WEEK IN TRADE.—The unseasonable weather was again the subject of complaint throughout a wide area, its effects being manifested in checking retail trade, the dulling of reorder business and in retarding collections. Wholesale trade in fall goods was brisk from all points, except where the crops have been seriously injured. Manufacturing plants are kept busy, a further increase in the rate of pig iron production failing to keep pace with consumption. Bank exchanges at New York for the week were 15.8 per cent less than last year, but at other leading cities there was an average gain of 17.3 per cent. Taken as a whole, crop reports are a trifle more encouraging, insect damage to wheat being reported checked in some States and fair progress being made in planting spring wheat in the Northwest. The cold weather, however, prevents best growth in winter wheat and oats and cotton and retards planting of corn. The iron and steel situation as a whole is stronger, both in crude and finished lines, despite current record outputs. Steel rails are being bought freely for 1908 delivery, and pig iron sells briskly for the last half of the year at higher prices. The April report of gross railway earnings shows a total aggregate increase over April, 1906, larger than in any month for over a year past, and fully 16 per cent larger than in April a year ago. The gross earnings thus far reported for May show a gain of 15.8 per cent over last year's figures. Copper was a little lower, and business was quiet, the demand being for immediate requirements only. Production is increasing. The closing quotations were 24⅞c. for lake; 24⅛c. for electrolytic, and 22⅝c. for casting stock. *Bradstreet's* reports 184 failures in the United States during the week, against 154 for the previous week, and 161 for the corresponding week of 1906.

THE NORTHERN LIGHT & POWER COMPANY, Redding, Cal., has brought suit in the Superior Court to condemn the right of about 25 land-owners along Cow Creek, in this county, to the 5000 miner's inches of water in said creek which the power company decides to convert for commercial purposes. The power company bases its claims on a water right of 5000 inches, filed on Old Cow Creek in 1904. The point of diversion is above the ranches of the 25 defendants. The company proposes to take this water from Old Cow Creek and lead it through ditches and flumes to its power-house site, where it will be turned into another creek, South Cow Creek, which will convey the water to Old Cow Creek at a point below the ranches of the 25 defendants. The water will be lost to them forever so far as irrigation purposes are concerned, and with the 5000 inches taken from the original stream there will not be enough left in the dry season, when water is needed most, to begin to supply their needs. The power company bases its right to take the water on the ground that it is a public service corporation. In other words, it has the same right to condemn riparian water rights that a railroad company has to condemn a farmer's land for a right of way for its track. The power company asks the court to determine the amount of damage each defendant farmer will suffer. It proposes to pay for what it takes. The suit is without a parallel. The farmers had supposed that their riparian rights were inalienable.

WESTINGHOUSE.—It is stated from Pittsburg that the Westinghouse shipment of material for the month of April was 63 per cent in excess of what it was during the same period of last year. All departments at the East Pittsburg shops are occupied to their fullest capacity. The structural work on the new addition has nearly all been erected and in another month the building will be under roof. The company has finished the installation of the Pittsburg & Butler Street Railway. Indications are that the entire $5,000,000, par value, of the new stock being offered to stockholders of the Westinghouse Electric & Manufacturing Company, at $75 per share, will be taken, thus giving the company $7,500,000 for the purpose of carrying through extensions planned and reimbursing the treasury for money spent in connection with extensions and betterments already completed. Warrants indicating the number of shares to which each shareholder is entitled are being sent out. A statement accompanies the warrants which reads as follows: "You will note that if payment is made in full June 3, you will receive the dividends payable July 10 and thereafter. As the dividend at the present rate equals $1.25 a share, the advantage of anticipating payments will be apparent, as the subscription price per share is practically reduced an equal amount, at which price the stock pays slightly more than 6¾ per cent on the cost of each share, which is in excess of the average return from other high-grade investment securities."

ROLLING MILL MOTORS.—The largest order for steel rails ever placed with a single concern was made public May 11. This was the order for 150,000 tons of steel rails placed by the Harriman lines with the Tennessee Coal & Iron Company for delivery after March, 1908. In order to handle its greatly increased business the Tennessee Company has placed an order with the Crocker-Wheeler Company, of Ampere, N. J., for the complete electric motor equipment of its new steel rail mill at Birmingham, Ala. The Crocker-Wheeler Company has, in fact, been obliged to open an office in Birmingham to handle the rapidly increasing business in this section. The order includes fifteen direct-current motors, designed for the arduous service of rolling mills, and aggregates about 575 horse-power. Among the other purchasers and users of the rolling mill motor are the following: Alliance Machine Company, Bethlehem Steel Company, Carnegie Steel Company, Illinois Steel Company, Lorain Steel Company, Mineral Point Zinc Company, Morgan Engine Company, National Tube Company, Pennsylvania Steel Company, Shelby Steel Tube Company, Tennessee Coal, Iron & Railroad Company, United Engine & Foundry Company and Youngstown Sheet & Tube Company.

THE ABNER DOBLE COMPANY, engineers, of San Francisco, has appointed Mitsui & Company to act as its sole agents in Japan and its territories, Korea, China and Manchuria, for the sale of Doble tangential water wheels and hydraulic apparatus. The industrial development that is now taking place in the Orient, and the increasing demand for high grade water wheel machinery will make this co-operative arrangement an advantageous one for both parties. Mitsui & Company is the largest and most progressive engineering house in the Far East, and with its 35 branch offices is in a particularly good position to handle the water wheel products of the Abner Doble Company.

STANLEY EXTENSIONS.—Plans have been prepared by the Stanley Electric Company, at Pittsfield, Mass., for a large foundry building. The building is to be in the form of a letter L and will be a combination monitor and three-story design. In one of the monitor parts of the structure will be the main casting room for generator frames, beds, etc., while another department will be given over to the casting of small parts by machinery. The building is to cost about $300,000 and a large amount will also be expended for huge cranes, pattern-making and casting machinery.

TELEPHONE ALLIANCE.—It is stated from Cincinnati that the local Bell Telephone Company has formed an alliance with the independent long distance companies and will be enabled to connect with over 100,000 new subscribers in Northern Ohio and many sections of Indiana. The agreement provides that in small towns where the two interests have been in competition, the stronger shall buy out the weaker, the company maintaining the field to connect with the Central Union Telephone Company for long distance service.

POWER IN NEVADA.—It is stated that a large power plant is to be built at Woodfords, Nev., near the head waters of the Carson River, to supply light and power to Carson City, Virginia, Reno, Buckskin, Ramsay, Wonder and Yerington. The lines will be extended as far south as Goldfield and Tonopah. It is rumored that the Southern Pacific Railroad Company is having this plant erected so as to obtain power to run electrical trains through the proposed tunnel through the Sierra Nevada Mountains.

APPARATUS IN MEXICO.—The Industrial Engineering & Supply Company, of Mexico City, Mex., has recently been organized by a number of prominent business and financial men who are familiar with the requirements of Mexican trade. It will do a general machinery and supply business, and has acquired the four-story building at Alcanceria No. 27, where it will carry a large portion of its stock of goods and make its general headquarters. The president of the company is W. W. Wheatley, until recently president and general manager of the Mexico City Tramway Company, who is also prominently identified with other important business and banking interests in Mexico City and Guadalajara. The general manager is James A. Peirce, formerly general superintendent of the Mexico City Tramway Company, and before that with the Rossiter-McGovern Company, of New York, N. Y. The general sales agent, William C. Benbow, has been in Mexico many years as an expert dealer in mining, milling and manufacturing machinery and electrical supplies, and is well known in these lines of trade throughout the country. The branch office of the Wellman-Seaver-Morgan Company has been moved from its former location at Second Dolores 20 to Alciaceria 27, and Mr. Benbow will hereafter act as sales manager for both the Wellman-Seaver-Morgan Company and the Industrial Engineering & Supply Company, S. A.

THE BRISTOL TRAMWAYS.—The Bristol Tramways & Carriage Company, Limited, of London, operating the tramways of Bristol, England, recently purchased through its manager, Sir J. Clifton Robinson, an Allis-Chalmers vertical cross-compound Reynolds Corliss engine with cylinders 26 in. and 56 in. x 48 in. stroke. This unit will be installed in the central power station at Bristol to drive a 1000-kw direct coupled, direct-current generator. The engine operating under 140 lbs. steam pressure will develop approximately 1700 i. h. p. The flywheel to be provided will have a diameter of 20 ft. and weigh approximately 93,000 lbs. The Bristol station now contains four Allis-Chalmers vertical cross-compound engines which are somewhat smaller than the new unit just purchased. They have cylinders 22 in. and 44 in. x 42 in. and are used to drive 550-kw generators. The engines now in the station have been in continuous operation for eight years. Sir James Clifton Robinson is also manager of the London United Tramways Station which contains three 22 in. and 44 in. x 42 in. vertical engines of the same size as those installed at Bristol and two larger units with cylinders 26 in. and 54 in. x 48 in., or about the same size as the new engine just purchased through the London office of the Allis-Chalmers Company, 533 Salisbury House, Finsbury Circus.

PITTSBURG SUPPLY CONSOLIDATION.—The Union Electric Company and the General Railway Supply Company, both of Pittsburg, have consolidated. The combined organizations will be operated under the name of the Union Electric Company, capital stock $250,000. The Union Electric Company was organized in 1905 and the General Railway Supply Company in 1896. The offices and warehouses of both concerns are now located at 31 Pittsburg Terminal Warehouses. The new company now occupies a 7-story warehouse, containing 20,000 square feet floor space. The new concern will continue the sale of lighting, railway, power, telephone and marine supplies. It will continue the agencies carried by the General Railway Supply Company, namely, R. D. Nuttall Co., gears, pinions and trolleys; International Register Products, General Electric line material and rail bonds; Crouse-Hinds arc headlights; Locke high tention insulators and Wilson trolley clutches; also motor and controller parts for Westinghouse and General Electric apparatus. The officers of the new company are: Messrs. Geo. W. Provost, president; Percy R. Frost, vice-president, and manager of lighting department; J. P. Provost, treasurer; L. H. Keller, secretary. Mr. Thos. M. Cluley has been appointed manager of the railway department.

GENERAL ELECTRIC OFFICERS.—The annual meeting of the General Electric Company was held May 14 at Schenectady, N. Y. These directors were elected: Gordon Abbott, Oliver Ames, T. Jefferson Coolidge, Jr., Frederick P. Fish, Geo. L. Gardner, Henry L. Higginson, Robert Treat Paine, 2d, all of Boston; C. A. Coffin, J. Pierpont Morgan, S. L. Schoonmaker, Charles Steele, all of New York; W. M. Crane, of Dalton, Mass.; Marsden J. Perry, of Providence, R. I.; J. P. Ord, of Albany, and E. W. Rice, Jr., of Schenectady. On May 15 at the directors' meeting in New York, the following officers were elected: C. A. Coffin, president; A. W. Burchard, assistant to the president; vice-presidents, E. W. Rice, Hinsdill Parsons, B. E. Sunny and J. R. Lovejoy; M. F. Westover, secretary; H. W. Darling, treasurer and assistant secretary; I. S. Keeler, second assistant secretary; H. P. Schuyler, assistant treasurer; Ed. Clark, general auditor; John Riley, assistant general auditor; S. L. Whitestone, assistant general auditor. The duties of the various vice-presidents remain the same as before the election. The appointments of Messrs. Sunny and Lovejoy as vice-presidents have given great satisfaction within the company and among their numerous friends in the entire electrical field.

LIGHTING AT CINCINNATI.—A contract has been agreed upon whereby the Union Gas & Electric Company will purchase from the Ohio Fuel Supply Company the natural gas to supply Cincinnati. In addition the local company secures the systems installed by the Ohio Fuel Supply Company at Norwood, Elmwood Place, Carthage, Lockland and Reading, and will furnish these places with gas. Payment for the gas is to be made from the gross earnings of the company, it is understood, the Ohio Fuel Supply Company receiving 65 per cent and the local company the remainder. In addition the Ohio Fuel Supply Company abandons its plan to furnish gas in Cincinnati and southwestern Ohio, leaving open the territory from Dayton on the north, and a point about 100 miles east of the city, which region will be developed by the local company. The artificial plants will be closed down, but they are to be kept in good condition, so that they may be put in operation at once, in case the natural gas fails. The gas is to be sold in Cincinnati at 30 cents per 1000 cubic feet. The deal will not affect the negotiations of the Columbia Company for the lease of the Cincinnati, Newport & Covington Light & Traction Company, it is said.

THE GENERAL INCANDESCENT LAMP COMPANY, whose home offices and factory are at 1811 East Forty-fifth Street, Cleveland, has just appointed the W. F. Irish Electric Company, of 60 Cortlandt Street, as its New York representative. This New York office will carry a stock of all types of lamps and is ready to fill all orders promptly. The General Incandescent Lamp Company is the company which recently secured the largest single order for Gem lamps in the world. This installation was made at the new Pierce office building, St. Louis. In this building there are 7614 sockets. Six thousand of these sockets contain 50 watt, 20 cp G. I. Gem lamps; 1014 in the lobbies contain 50 cp G. I. Gem high efficiency units.

SALES OF BARRIETT MOTORS.—Among recent installations of Barriett motors by the Barriett Electric Manufacturing Company, of Cincinnati, are the following: Bucher Packing Company, Cairo, Ill.; Cincinnati Wire Bound Box Company, Cincinnati; Shepard Lathe Company, Cincinnati; Bedford Cut Stone Company, Rapid Electrotype Company, Cincinnati, 40 motors from ½ to 10 hp; Queen City Machine Tool Company, Cincinnati, Ohio; John A. Traylor Machinery Company, Denver, Col.

Financial Intelligence.

THE WEEK IN WALL STREET.—The stock market was very dull, speculative interest being largely diverted to wheat. Adverse crop reports also had the effect of restricting interest in stocks, and nervousness regarding the agitation against railroads was illustrated by a selling movement in Union Pacific on the appearance of a rumor that the Interstate Commerce Commission had adopted a report severely condemning the policy of that corporation. There was some recovery, however, when it was learned that there was no foundation for the rumor. The local franchise properties were quiet and neglected, notwithstanding the fact that more or less unfavorable talk was heard about them, based on the probable passage of the public utilities bill at Albany. The General Electric Company has joined the ranks of the concerns which are seeking additional capital, the matter in this case taking the form of a $15,000,000 convertible bond issue. There was some bearish manipulation in Reading, American Smelting and Canadian Pacific, while National Lead developed unexpected strength. As a rule, however, the movements of prices were narrow and unimportant. Electric and traction stocks were weak, and prices generally showed the downward tendency. Toward the close of the week General Electric dropped several points, the last quotation showing a net loss of 4½. This was the heaviest decline in the electric list, changes in other stocks of this class being merely fractional. On the curb market there was a general disposition

to liquidate, particularly in the various "rights," including those of the Harriman securities. There was a very light demand for all low priced issues. Following are the closing quotations of May 21:

NEW YORK.

	May 14	May 21		May 14	May 21
Allis-Chalmers Co.	11¾	9	General Electric	146	140
Allis-Chalmers Co. pfd.	31	27⅛	Hudson River Tel.	—	—
Am. Dist. Tel.	—	—	Interborough Met. Com.	22½	19
American Locomotive	62	58	Interborough Met. pfd.	56⅞	53⅜
Amer. Locomotive pfd.	108	105	Mackay Cos.	—	—
American Tel. & Cable.	75	75	Mackay Cos pfd.	—	—
American Tel. & Tel.	—	—	Marconi Tel.	—	—
Brooklyn Rapid Transit.	60	53	Metropolitan St. Ry.	—	—
Electric Boat	36	35	N. Y. & N. J. Tel.	—	—
Electric Boat pfd.	81	82	Western Union Tel.	82½	81½
Electric Vehicle	—	—	Westinghouse com.	144	143
Electric Vehicle pfd.	—	—	Westinghouse pfd.	—	—

BOSTON.

	May 14	May 21		May 14	May 21
American Tel & Tel.	124	123	Mass. Elec. Ry pfd.	57¾	—
Cumberland Telephone.	—	—	Mexican Telephone	—	—
Edison Elec. Illum.	208	216	New England Telep.	119	—
General Electric	—	142⅜	Western Tel. & Tel.	—	6½
Mass. Elec. Ry.	—	17	West. Tel. & Tel. pfd.	71	71

PHILADELPHIA.

	May 14	May 21		May 14	May 21
American Railways	49¼	49	Phila. Electric	8⅜	8¼
Elec. Co. of America	10	10	Phila. Rapid Trans.	24¼	23
Elec. Storage Battery	50½	50	Phila. Traction	—	91¼
Elec. Storage Bat. pfd.	—	—			

CHICAGO.

	May 14	May 21		May 14	May 21
Chicago City Ry.	180	180	National Carbon	71¼	71
Chicago Edison	—	—	National Carbon pfd.	110	110
Chicago Subway	—	15⅜	Union Traction	—	—
Chicago Tel. Co.	—	—	Union Traction pfd.	—	—
Metropolitan Elec. com.	23	23			

INTERBOROUGH-METROPOLITAN.—The annual report of the Interborough-Metropolitan Company, of New York City, shows a deficit for the year ended March 31 of $1,347,489, compared with last year's deficit of $2,341,878. The earnings from operations of the combined roads increased during the fiscal year by $2,660,170 to $43,353,841. Operating expenses rose in lesser proportion, standing at $21,841,884, which was an increase of only $979,368 over the previous year. The net earnings were $21,511,957, against $19,649,155 in 1906, but other income fell off from $1,215,781 to $1,187,464, leaving the gross income at $22,699,421, $1,834,485 more than last year. Of this gain $1,157,270 was lost in an increase in the items of interest and rentals, which include the 7 per cent dividend guaranteed on the stock of the Metropolitan Street Railway Company. Taxes are placed in the report at $2,544,325, exclusive of the special franchise tax, which is in litigation, and the deduction of these items from the gross income leaves a balance of $4,742,869, an increase of $644,859 over last year. After the payment of interest on the 4½ per cent Interborough-Metropolitan bonds and of dividends as guaranteed on the outstanding Metropolitan Street Railway stock, there remained a balance of $926,501, which was applied to dividends of 5 per cent cumulative preferred stock of the company, of which $45,479,800 was outstanding during the year. The full payment of this dividend of 5 per cent called for a disbursement of $2,273,990, and, as the balance only amounted to 2.04 per cent on this amount of stock, the payment resulted in the above-mentioned deficit of $1,347,489.

DIVIDENDS.—The Philadelphia Electric Company has declared the regular semi-annual dividend of 2½ per cent (25 cents per share) on the paid-in capital stock, payable June 15. The directors of the Kings County Electric Light & Power Company have declared the regular quarterly dividend of 2 per cent on the capital stock, payable June 1. The American Graphophone Company has declared a quarterly dividend of 1¼ per cent on the common stock, payable June 15. The directors of the Paducah Traction & Light Company have declared a dividend of 1 per cent on the preferred stock, payable June 1. The directors of the Northern Ohio Traction & Light Company have declared a quarterly dividend of ½ of 1 per cent, payable June 15. The directors of the Pensacola Electric Company have declared a dividend of 3 per cent on the preferred stock, payable June 1. The directors of the Rochester (N. Y.) Railway Company have declared the regular quarterly dividend of 1 per cent, payable May 31. The directors of the Chestnut Hill Railway Company, Philadelphia, have declared the regular quarterly dividend of 1½ per cent, payable June 4. The guaranteed quarterly dividend of 1¼ per cent on the stock of the American Telegraph & Cable Company will be paid June 1. The directors of the Washington Railway & Electric Company have declared the regular semi-annual dividend of 2½ per cent on the preferred stock, payable June 1.

BELL TELEPHONE.—Advices from Boston state that in the last four years the outstanding capital stock of the American Telephone & Telegraph Company has increased from $87,836,100, on Jan. 1, 1903, to $131,551,400 on Jan. 1, 1907, a gain of $43,715,300, or 49 per cent. In the same time the number of stockholders has increased from 10,790 to 18,194, a gain of 7,404, or 68 per cent. In the following table are shown the outstanding capital stock as of Jan. 1, 1903, 1904, 1905, 1906 and 1907, and the number of shareholders and average number of shares held by each stockholder on those respective dates:

	Outstanding Capital Stock.	No. of Stockholders.	Average Shares Per Stockholder.
Jan. 1, 1903	$87,836,100	10,802	81.3
Jan. 1, 1904	127,068,900	15,743	80.7
Jan. 1, 1905	131,551,400	16,892	77.8
Jan. 1, 1906	131,551,400	17,565	74.8
Jan. 1, 1907	131,551,400	18,194	72.3

The decrease of nine shares in the average holdings per stockholder is testimony of a steady growth in the constituency of the company.

U. S. TELEPHONE ANNUAL.—The United States Telephone Company has issued its annual report for the year ended Dec. 31, 1906. The income account compares as follows:

	1906.	1905.		
Gross	$402,052	$348,716	Inc.	$53,336
Expenses	172,955	183,986	Dec.	11,031
Net	$229,097	$164,730	Inc.	$64,367
Other income	18,102	.....	Inc.	18,102
Total income	$247,199	$164,730	Inc.	$82,469
Charges	107,800	103,198	Inc.	4,602
Balance	$139,399	$61,532	Inc.	$77,867
Preferred dividend	27,631	19,515	Inc.	8,116
Balance	$111,768	$42,017	Inc.	$69,751
Common dividend	53,250	.....	Inc.	53,250
Surplus	$58,518	$42,017	Inc.	$16,501

The balance of $111,768 was equal to 3.58 per cent on the $3,100,000 common stock outstanding Dec. 31, 1906.

GENERAL ELECTRIC BONDS.—In his recent annual report President Coffin referred to the need of new capital as a result of the continued rapid growth of the business. This has now been taken care of at a directors' meeting last week when it was voted to issue approximately $13,000,000 of 5 per cent ten-year convertible debenture bonds. The bonds are to be dated June 1, 1907, and will be convertible after June 1, 1911, into stock of the company at par. They will be redeemable at 105 after the same date upon ninety days' notice, subject, however, to the stockholder's right of conversion. The amount of the issue will be equal to one-fifth the outstanding capital stock, which is now slightly above $65,000,000. Rights will accrue to shareholders of record on June 20, and subscriptions will be closed on July 20. The subscription price will be par and interest, and payments will be due one-half on July 20, 1907, and one-half on Jan. 20, 1908, the stockholder having the privilege of making full payment on July 20, whereupon bonds, or negotiable receipts therefor, will be delivered to him.

SOUTH AMERICAN CABLE.—The Central & South American Telegraph Company has authorized an increase of the capital stock from $8,000,000 to $12,000,000. Of the increase, $2,000,000 is to be distributed to shareholders of record May 14 as a 25 per cent stock dividend to be issued on June 1. This amount covers expenditures for the Chorrillos, Iquique and Valparaiso duplicate cable and other extensions and betterments. The remaining $2,000,000 is to be issued as the directors may determine for capitalizing future improvements, which will include the New York and Colon cable and extensions in South America and Argentina.

B. R. T. BOND ISSUE.—The following statement has been issued by Mr. C. D. Meneely, secretary and treasurer of the Brooklyn Rapid Transit Company: A special meeting of the stockholders will be held on June 10 and 11, to authorize a mortgage on the Brooklyn Union Elevated Railroad Company for $20,000,000, and one on the Nassau Electric Railroad Company for $5,000,000, to secure certificates of indebtedness to the Brooklyn Rapid Transit Company for advances to enable the railroad company to make necessary improvements to its road and equipments.

GENERAL NEWS

Construction News.

ANNISTON, ALA.—Howard W. Saxton, representing the Little River Electric Power Company, has petitioned the Board of County Commissioners for a right of way over the county roads from the Cherokee line to Anniston, for the purpose of erecting a transmission line from its plant to this city.

BESSEMER, ALA.—The question of constructing a municipal electric light plant is under consideration here. Alderman O'Gara, is a member of the Street and Lighting Committee.

GADSDEN, ALA.—The North Alabama Railway, Light & Power Company has been sold to the Alabama Railway, Light & Power Company, which has also absorbed the Little River Power Company. The company will also take over the street railway and lighting properties at Anniston and Talladega. The officers of the company are: T. H. Henderson, of Durango, Col., president; J. H. Hill, of Fort Payne, Ala., vice-president; L. C. Young, of Chattanooga, Tenn., secretary and treasurer.

GLOBE, ARIZ.—It is reported that Col. E. Randolph is contemplating the conversion of the old "M P" railway into an electric line and will extend the line from Mesa to Roosevelt.

EARL, ARK.—The capital stock of the Earl & Tyronza Telephone Company has been increased from $5,000 to $10,000.

RUSSELLVILLE, ARK.—Work will commence at once on the electric light plant and electric street railway, which is to be built by the Southern Engineering Company, of Pine Bluff. The combined system will cost about $200,000. Adam J. Robinson, of Pine Bluff, is president of the company, and J. C. Wilson, of St. Louis, Mo., secretary.

ALAMEDA, CAL.—The Electric Light Commission has been organized by the election of W. J. Graham as president, and A. D. Goldsworthy, secretary.

FAIRFIELD, CAL.—E. D. N. Lehe, owner of the Dixon electric lighting system, has secured a temporary permit from the Board of Supervisors to erect a transmission line along the county road from Dixon to Rio Vista, and also the promise of the board that it will offer for sale on June 3 next a blanket franchise for a power transmission line along the county roads in Silveyville, Elmira and Green Valley townships and along the road to Rio Vista. Mr. Lehe is planning to furnish electricity to the farmers who desire to pump water for irrigation.

FRESNO, CAL.—The Chinese merchants of this city propose to install an electric lighting plant. A company has been incorporated under the name of the Fresno Mutual Electric Light Company. The directors are Tong Duck, Sing Chung Lung, J. E. Ragsdale and others.

MONTEREY, CAL.—The stockholders of the Monterey & Pacific Grove Street Railway & Electric Power Company will meet July 6, to vote on the proposition of increasing the capital stock of the company from $180,000 to $600,000, and if found advisable to increase the bonded indebtedness by the sum of $300,000. George Heazleton is president of the company.

OAKLAND, CAL.—The Board of Public Works has adopted a resolution providing for the erection of a pumping station for the salt water fire and street sprinkling plant on the shore of Lake Merritt. The pumps will be operated by electricity, and a gasoline engine will be installed to be utilized in cases of emergency. The cost of the plant is estimated at $70,000.

OAKLAND, CAL.—Extensive improvements are contemplated by the Oakland Gas, Light & Heat Company to its plant on First and Grove Streets. The power house will practically be rebuilt. The company has recently purchased a turbo-generator set of 8000 kilowatt capacity. Steam will be supplied by two batteries of water-tube boilers of 16,000 horsepower capacity.

SACRAMENTO, CAL.—Prof. C. L. Cory, head of the department of engineering of the University of California, is making investigations for the purpose of estimating the cost and maintenance of a municipal electric lighting plant. It has been suggested that the city issue 10-year bonds and have the plant erected by private parties.

SAN BERNARDINO, CAL.—The San Bernardino Interurban Railway has filed a first mortgage to the Los Angeles Trust Company, as trustee, to secure an issue of $1,000,000 in bonds to be used in building interurban lines from San Bernardino.

SANTA ROSA, CAL.—Application has been made to the Board of Supervisors by Frank M. Burris, cashier of the Santa Rosa Bank, for a franchise for the distribution of electricity for lighting, heating, and commercial uses all through Sonama County. The Eel River Power Company is believed to be behind the project.

BOULDER, COL.—The construction of another large water power plant is under consideration by the Boulder Hydro-Electric Company, which was formed for the purpose of developing the water power of Boulder Creek below Barker meadows east of Nederland; the water will be conducted by the means of a pipe line to a power station at the Wheelman tunnel, east of Eagle Rock, where a large generating station will be located. It is estimated that 10,000 hp can be generated there. Another power station will be erected near the mouth of Four Mile Creek, and the third station will be erected near the mouth of Boulder Cañon. It is estimated that about 5000 hp can be generated at the two additional plants, which will give the company a total of 15,000 horse-power. The incorporators of the company are James Cowie, William Babcock and Norton Montgomery.

SOPRIS, COL.—Gen. E. R. Sopris has made application to the State Land Board to purchase a section of coal land near Sopris upon which to erect a power plant and derricks, which will cost between $350,000 and $400,000.

TRINIDAD, COL.—The commissioners of Las Animas County have granted a franchise to a company represented by C. L. Hendershot to construct and operate an electric light plant.

BRIDGEPORT, CONN.—The Common Council has granted the United Electric Illuminating Company permission to place its wires underground in many streets in the city. The Council also voted to request the company to provide special ducts for the use of the city in putting the fire alarm system underground.

MELROSE, CONN.—The Northern Connecticut Gas & Electric Light Company is preparing to extend its lines through Melrose. Many residents of this place have signified their intention of installing electricity for lighting their houses as soon as it is available.

SOUTH NORWALK, CONN.—At a special meeting held May 13 the citizens voted to appropriate $27,000 for enlargement of the municipal electric light plant.

WASHINGTON, D. C.—Bids will be received at the Bureau of Supplies and Accounts, Navy Department, Washington, D. C., until May 28, for furnishing naval supplies at the various navy yards and naval stations, as follows: Portsmouth, N. H.: Schedule 801, electric cable and conductor. Boston, Mass., schedule 812, electric wire, etc. Newport, R. I., schedule 798, smokestack and flues, and boilers, etc. New York, N. Y., schedule 767, water-tube boilers. Annapolis, Md., schedule 805, incandescent lamps, etc. Applications for proposals should designate the schedules desired by number. E. B. Rogers, paymaster-general, U. S. A.

AUGUSTA, GA.—The Augusta-Aiken Railway & Electric Company is contemplating the development of a water power of 20,000 horse-power on the railway extension to Columbia, S. C. E. P. Wetmore is manager.

BRUNSWICK, GA.—The Fore River Shipbuilding Company has placed a contract with the Florida Electric Company, of Jacksonville, for the construction and equipment of an electric plant of 150-kw capacity at the terminals of the Atlanta, Birmingham & Atlantic Railroad. The plant will cost about $25,000, and the contract provides for 177 arc lamps and 1000 incandescent lamps, all of which will be used at the terminals.

DOUGLAS, GA.—A. B. Finley and E. Jowers, of Oserfield, are contemplating building an electric railway in Douglas, and will soon make application to the City Council for a franchise and will also apply to the Secretary of State for a charter.

MACON, GA.—Bids will be received by the City Council until June 11 for furnishing light and water to city. In the meantime the city electrician has been asked to furnish an estimate for erecting and maintaining a municipal electric light plant.

NEWMAN, GA.—E. D. Foure, city clerk, writes that the citizens on May 4 voted to issue $13,000 in bonds to construct an electric light plant.

NEWMAN, GA.—Bids will be received until June 3 by the Newman water and light commissioner for the following apparatus for its proposed electric station: Two 150-kw revolving-field alternators for direct connection to steam engines; two medium-speed steam engines for direct connection to above alternators; one switchboard complete. W. B. Pringle is secretary of the commission.

WAYCROSS, GA.—The City Council has granted to Burdette Loomis, George W. Deen, of Waycross, and F. H. Elmore, of Jacksonville, a franchise to construct and operate a street railway system in this city.

MOSCOW, IDAHO.—The Idaho-Washington Light & Power Company, formerly known as the Moscow Light & Power Company, has filed articles of incorporation with a capital stock of $500,000. The company now controls eleven electric light stations. The main office of the company will be in Moscow and the officers are M. J. Shields, president; E. S. Aldrich, vice-president and general manager, and G. W. Aldrich, secretary.

WALLACE, IDAHO.—The Wallace Light & Water Company has decided to expend about $50,000 in improvements to its system. Robert E. Strahom, of Spokane, is president and manager.

ARLINGTON HEIGHTS, ILL.—Messrs. Bray and Kates of this place are preparing to install a small electric lighting and power plant, and have recently purchased machinery of the Allis-Chalmers Company.

CHICAGO, ILL.—Swift & Co. are contemplating the erection of a large power plant in connection with the plant at their stock yards.

EDWARDSVILLE, ILL.—Capitalists in Edwardsville and a number of nearby cities are planning an electric railway from Lebanon to Mt. Olive. A branch is also contemplated from Highland to Maryville. The new line will connect with the East St. Louis & Suburban at Maryville and Lebanon.

ELGIN, ILL.—The Aurora City Council has granted a franchise to the Aurora, Elgin & Chicago Railway Company to extend its lines to Pigeon Hill.

GARY, IND.—The United Steel Corporation has secured a 50-year franchise for gas, water, electric light and street car service in Gary.

KNIGHTSTOWN, IND.—C. F. Baxter, city clerk, writes that the question of enlarging and improving the municipal electric light plant is under consideration.

LAFAYETTE, IND.—Cuno Kibele, of Muncie, architect, is preparing plans for a refrigerating, electric plant and water works for the Soldiers' Home, and bids for the same will be received on May 28. W. S. Haggard is president.

LA PORTE, IND.—The capital stock of the La Porte Telephone Company has been increased from $50,000 to $100,000.

MARION, IND.—Arrangements are being made by the Marion, Bluffton & Eastern Traction Company to issue $850,000 in bonds, the proceeds of which are to be used for construction purposes.

RED KEY, IND.—The question of constructing municipal water works and an electric light plant is being considered here.

VINCENNES, IND.—The Vincennes Light & Power Company has sold its electrical plant to a Boston syndicate, which was represented by Charles W. Sherman. The new company, which will be known as the Vincennes Electrical Company, will remodel the plant and improve the entire lighting system. Albert Heitz has been appointed superintendent of the plant. The old company will continue in business and give its entire attention to the gas system.

COUNCIL BLUFFS, IA.—The directors of the Independent Telephone Company have passed a resolution calling for an expenditure of $42,000 for new construction work this year.

DAVENPORT, IA.—Extensive improvements are being contemplated for the plant of the People's Light Company, which will involve an expenditure of about $230,000.

OSCEOLA, IA.—George B. Linney, of Osceola, is interested in the construction of a dam over Osage River for power purposes, the cost of which is estimated at about $18,000.

SHARON CENTER, IA.—The capital stock of the Farmers' Mutual Telephone Company has been increased from $4,500 to $9,000.

SIDNEY, IA.—The Shenandoah Electric Light & Power Company, of Shenandoah, is contemplating extending its transmission lines to this place to supply electricity for lighting and power purposes.

FORT RILEY, KAN.—Bids will be received until June 1 by Capt. W. M. Whitman, constructing quartermaster, U. S. A., for furnishing and installing electric light fixtures in buildings at this post.

IOLA, KAN.—The Kansas City Southern Railway is contemplating the construction of a power house in this place.

LOUISVILLE, KY.—As a result of the decision of the Louisville Lighting Company to discontinue the distribution of the 110 and 220-volt service, which it has furnished its subscribers for a number of years, many merchants within the boundary of First and Tenth and Main and Walnut Streets, are having to replace their present electrical equipment with machinery that will carry the regular 500-volt service. The change will require the installation of new motors and equipment. A. M. Worthington is manager of the Louisville Lighting Company.

FRANKLIN, LA.—John C. Lewis, mayor, writes that bids will be received on June 5 for electric light plant, to cost about $30,000. Warren B. Reed, New Orleans, is the engineer.

AUGUSTA, ME.—The city has recently entered into a new contract with the Kennebunk Light & Heat Company, whereby several concessions have been secured by the city. Under the new contract all the lamps will be in operation from dusk until daylight. A reduction has also been secured in the price of arc lamps from $75 to $65 per year, and in the series incandescent lamps from $36 to $30 per year, this being in addition to the reduction in commercial rates. The city also gets the benefit of commercial rates in the hose houses, City Hall and school buildings, and secures the right, if the company sells its plant to any merger, to cancel the contract.

FAIRFIELD, ME.—Surveys have been made and plans completed for the construction of an electric railway to be built to Shawmut this summer. A. F. Gerald is interested in the project.

BALTIMORE, MD.—The Baltimore Electric Light & Power Company is considering the question of increasing the capacity of its plant from 1000 to 3000 kilowatts.

AMHERST, MASS.—Charles S. Cushman has completed arrangements for running his paper mill at Cushman by electricity. A 50-hp motor has already been placed in the plant, and a contract awarded for another of the same capacity. For the present, electricity for operating the plant will be furnished by the Amherst Gas Company, and later, when the transmission line is completed from Turners Falls, electric energy will be furnished by the Connecticut Valley Power Company.

BOSTON, MASS.—Plans have been made for the construction of a power station on the east shore of the Seekonk River, and a sub-station near the Boston end of the route, by the proposed Boston & Providence Electric Railway.

BROCKTON, MASS.—The Edison Electric Illuminating Company has placed contracts for the immediate erection of a new power plant at East Bridgewater. The new power house will be equipped with two 2500-hp steam turbines, together with boilers and other necessary equipment. The company is also planning to increase the capacity of its power plant in this city to provide for the increased lighting load and will build an addition to its present power house at a cost of $150,000, which with the new underground work will entail an expenditure in this city alone of $250,000. The company is making an aggressive campaign for the installation of electric motors for power purposes. In addition to the new construction work the company is replacing the present arc lighting system with new and improved arc lamps.

CHICOPEE, MASS.—Preparations are being made for placing the contracts for new equipment for the municipal electric light plant, which will be awarded as soon as the Aldermen pass on the second reading of the ordinance appropriating the money for improvements and additions to be made to the plant. Two 180-kw generators will be purchased, one of which will be ordered immediately to take the place of the old arc light machines now in use. As soon as the new generator is placed 150 open arc lamps will be replaced by luminous arc lamps.

FALL RIVER, MASS.—Small Brothers, of this city, have commenced the erection of a new power house, which will cost about $10,000.

GARDNER, MASS.—Plans have been completed by the Gardner Electric Light Company for enlarging its power plant, which will double the capacity of the plant. The contract for the construction of the power house has been awarded to Scoville & Wheeler, of Worcester, Mass. The company has purchased two American Diesel oil engines of 225 horse-power each, a new Stanley alternating-current generator of 280 kilowatt capacity and a 190-kw Triumph direct-current generator. The latter generator will be used to furnish electricity for manufacturing purposes. The company has recently contracted with P. Derby & Company to furnish electricity to operate the entire factory. The above improvements will involve an expenditure of about $50,000.

MATTAPOISETT, MASS.—The Selectmen have granted the New Bedford Gas & Edison Light Company a franchise to furnish electricity in this town.

NORTH ABINGTON, MASS.—The Electric Light & Power Company, of Abington and Rockland, is extending its service to the towns to the east. The company recently established a lighting and power service in Hanover, and is now negotiating with the water commissioners of Rockland and Abington to extend a special wire from Hancock to the pumping station in Pembroke, a distance of seven miles, for power purposes.

ROCKLAND, MASS.—The joint board of water commissioners of Abington and Rockland are considering the question of operating the pumping station at Big Sandy Pond, in Pembroke, by electricity. The Electric Light & Power Company, of Abington and Rockland, has submitted a proposition to the officials to extend its service from Hanover Four Corners to the pumping station if the proposition is accepted.

SPRINGFIELD, MASS.—Extensive improvements are planned for the power station of the Springfield Electric Railway Company at Goulds Mills. A pair of water wheels will be installed to operate two 200-kw General Electric generators. The contract for this work has been awarded to Black & Company, of Keene, N. H. The dam will be repaired and raised this summer. The storage battery plant located near the power station of the Springfield Electric Company will also be overhauled.

STOUGHTON, MASS.—The electric light station of the Stoughton Gas & Electric Company will soon be discarded and electricity for lighting purposes will be furnished from Brockton. The property of the above company has recently come into the control of Stone & Webster, of Boston, who have notified the Selectmen that they propose to furnish electricity from the Brockton plant and will only operate the gas plant in this place.

GRAND RAPIDS, MICH.—The Grand Rapids-Muskegon Power Company will commence the erection of another transmission line to this city as soon as the Croton Dam is in operation.

LANSING, MICH.—The Michigan Power Company has submitted to the Board of State Auditors a proposal to heat the state capitol for the next two years at $7,250 a year, provided the board continues to use the company's electricity for lighting and power purposes. On the same conditions it would heat the old state block at $1,750 a year. Otherwise the company would heat the capitol for $10,000 a year and the old state block for $2,387.

MARCELLUS, MICH.—The contract for the generator for the electric lighting plant will soon be awarded. Frank W. Knapp is interested in the project.

SAULT STE. MARIE, MICH.—The Sault Ste. Marie Gas & Electric Company has recently floated its $100,000 bond issue, the proceeds of which will be used to continue the extensions of its system. The plant of the company was only recently completed.

AURORA, MINN.—The organization of a company and application for a franchise for the establishment of an electric light plant is now under consideration by C. R. Hill and other local business men.

CANNON FALLS, MINN.—The question of constructing an electric light plant, at a cost of about $10,000, is under consideration.

ISANTI, MINN.—The Council is said to be procuring estimates for lighting the town by electricity.

MINNEAPOLIS, MINN.—The City Council on May 10 passed the electric light ordinance, which provides for converting the unused pumping stations into electric light plants. The plan is first to supply the city with electricity needed for public lighting, and later to develop the plant so that it can supply electricity to private consumers.

ROCHESTER, MINN.—It is reported that the Great Western Railway has under consideration the construction of an electric railway from Rochester to Winona, and also to Osage, Ia., and to Red Wing.

ST. PAUL, MINN.—The Northern Heating & Electric Company has completed arrangements to absorb the entire distributing system of the Manhattan Light & Power Company, and has applied to the Council for approval of the proposed merger. Should the Council approve of the merger the Northern Company will take over the conduits, wires and contracts of the Manhattan Company. The power plant of the Manhattan Company is not included in the sale and should the transaction go through this plant will be closed and the electric wires and steam heating pipes will be connected with the Northern Heating & Electric Company's plant. The Manhattan Company has operated for a number of years in a restricted portion of the downtown district.

JACKSON, MO.—Plans for a combined electric lighting and water works pumping station for this city are being prepared by Hiram Phillips, St. Louis. The entire work is to cost about $35,,000.

KANSAS CITY, MO.—A. L. Thompson, of this city, is reported interested in a company which will erect a public service electric power station in Zamboaiga, Mindanao, P. I. Plans for the plant have not been made and the company is said to be desirous of securing proposals from engineering firms capable of making complete plans.

MEMPHIS, MO.—The Iowa-Missouri Traction Company has filed a mortgage with the Knickerbocker Trust Company, of New York, N. Y., to secure an issue of $1,000,000 in bonds. The company proposes to construct an interurban railway from Fairfield, Ia., to this city. H. Blackledge is president of the company.

NEVADA, MO.—The Missouri Water & Light Construction Company will expend about $100,000 in reconstructing and improving the combined public service and street railway power station in this city. An air compressor, steam boilers, street railway supplies and other supplies will be purchased. Hiram Phillips, St. Louis, is preparing plans for the work.

ST. LOUIS, MO.—The Union Electric Light & Power Company, which has the city electric lighting contract, is said to have offered to make a reduction in the present lighting rates from $98 to $70 each for arc lamps if it is given a contract for 10 years, to begin at the expiration of the present contract in 1910. This will mean a reduction in the annual lighting bill of more than $100,000. The Board of Public Improvements is considering a bill providing for letting the new contract immediately. If the bill passes the Municipal Assembly and the contract is let within two or three months, out-of-town lighting companies can enter into competition with the local company.

SPRINGFIELD, MO.—The citizens have voted to grant Edward V. Williams, A. J. Eisenmayer and others a lighting franchise. The company proposes to construct a power plant on the north side to furnish heat, gas, light and power to city.

RED LODGE, MONT.—The Northwestern Improvement Company has decided to construct a new electric power house.

ASHLAND, NEB.—The plant of the Ashland Light, Mill & Power Company located on Wahoo Creek was destroyed by fire on May 9, entailing a loss of about $10,000. The town will be without electric light for several months.

LINCOLN, NEB.—The State Board of Lands and Buildings has awarded a contract to the Westinghouse Electric & Manufacturing Company for the installation of a 40-hp motor at the penitentiary, to cost $509. A dynamo is to be installed later, which will furnish electricity for light and power to the state capitol building and the Home for Friendless.

OMAHA, NEB.—Work has commenced on the addition to the power house of the Omaha Electric Light & Power Company at Fourth and Jones Streets, the cost of which is estimated at $5,000.

STANTON, NEB.—The City Council has revoked the franchise of the electric light company to whose rights Frank Sanders has succeeded. The Council has also ratified the employment of W. W. Young and R. P. Cowan as special attorneys employed by the city to secure the purchase and installation of an electric lighting plant.

SECAUCUS, N. J.—Bids will be received by the Board of Chosen Freeholders until May 23, for wiring and installation of an electric lighting system in the New County Alms House at the County Farm, at Secaucus. Walter O'Meara, of Jersey City, is clerk.

AKRON, N. Y.—The Town Board has granted the Genesee Electric Power Company a franchise to build a transmission line through the town to the stone crushing plant at west end of village.

ALBANY, N. Y.—The Senate has passed the O'Neil-Merritt bill, incorporating the Long Sault Development Company. This was the bill which, after passing both Senate and Assembly, reached the Governor, and was amended at his request by its authors, so as to provide for proper compensation to the state for the privileges granted the company.

BROOKLYN, N. Y.—Bids will be received by John H. O'Brien, commissioner water supply, gas and electricity, New York City, until May 28, for furnishing, installing, maintaining and reserving for the use of the high-pressure fire service, all apparatus and equipment necessary for generating and transmitting 1830 kw of three-phase, 6600-volt, 25-cycle electrical power, and furnishing and delivering this power under terms of this contract to Dec. 31, 1907, at each of the high-pressure fire service pumping stations, located in the borough of Brooklyn, at Furman and Joralemon Streets, and at Willoughby and St. Edwards Streets, respectively.

COEYMANS, N. Y.—The Atlantic Light & Power Company on May 9 was granted a franchise by the Town Board, and immediately afterward the electric lamps were in operation. The company is planning to light Ravena also, and plans to have a permanent plant in operation within five months.

CORONA, L. I., N. Y.—Bids will be received until May 27 by C. B. J. Snyder, superintendent school buildings, New York City, for installing electric equipment in School 16, Corona, borough of Queens.

MADISON BARRACKS, N. Y.—Bids will be received by the constructing quartermaster at Madison Barracks until June 1 for constructing an electric lighting system at the post, also for furnishing electricity for exterior and interior lighting.

MARCELLUS, N. Y.—Work will soon commence on the construction of the new electric light plant. Frank W. Knapp is interested in the project.

MIDDLETOWN, N. Y.—The State Commission of Gas and Electricity has authorized the Orange County Lighting Company to issue $45,000 in bonds, the proceeds of which are to be used for the purpose of extensions and betterments to its plant.

NEW YORK, N. Y.—Bids will be received until May 27, by C. B. J. Snyder, superintendent school buildings, for installing electric equipment in additions to and alterations in School 32.

NEW YORK, N. Y.—Plans have been filed for a two-story concrete and brick power house for the New York Edison Company to be erected at 259 West 123d Street, to cost $70,000. Charles F. Hoppe is the architect.

NEW YORK, N. Y.—Bids will be received by John H. O'Brien, commissioner water supply, gas and electricity, New York City, until May 28, for furnishing, installing, maintaining and reserving for use of the high-pressure fire service, all apparatus and equipment necessary for generating and transmitting 3250 kw of three-phase, 6600-volt, 25-cycle electrical power, and furnishing and delivering this power under the terms of this contract to Dec. 31, 1907, at each of the high-pressure fire service pumping stations, located in the borough of Manhattan, at Oliver and South Streets, and at Gansevoort and West Streets, respectively.

OGDENSBURG, N. Y.—The State Commission of Gas and Electricity has granted the petition of the New York & Ontario Power Company to transact business and to issue $150,000 in stock and $150,000 in bonds. The proceeds from the sales of securities allowed will be used to take over certain water power and rights at Waddington, to purchase the Waddington electric light plant and for extensions and repairs to the plant.

PIERMONT, N. Y.—The Rockland Railroad Company has been granted a franchise by the Village Trustees for the construction of an electric railway through the village. Application will also be made to the Town Board of Orangetown for a franchise over the roads in the villages not incorporated in order to reach the New Jersey line, to make connections with a line to New York.

SHERBURNE, N. Y.—Levi Collins, village clerk, writes that bids will probably be called for in June or July for the construction of an electric light plant, to cost about $15,000. H. B. Sweet, of Utica, is the engineer.

SYRACUSE, N. Y.—The State Railroad Commission has granted the Syracuse & South Bay Railway Company permission to issue a first mortgage of $1,000,000, the proceeds of which to be used for construction of the road.

GOLDSBORO, N. C.—The State Commission at Raleigh has decided to expend about $10,000 for a system of electric lighting for the asylums at Goldsboro and Morgantown.

GREENSBORO, N. C.—The Greensboro Electric Company has sold its plant and holdings to W. T. Vanbrunt, of New York, N. Y., and Dee Allen and associates, who will soon take over the plant. The new owners have acquired a franchise for a railway from High Point to Greensboro, and are now constructing an electric railway from High Point to connect with the company's steam road from Thomasville to Glendon.

WILMINGTON, N. C.—The city has granted a franchise to the Tidewater Power Company, a subsidiary company to the Hugh MacRae & Company interests, developing a large water power on the Pee Dee River, 100 miles distant, to transmit electricity to Wilmington to operate the public lighting plant, and supply power probably for the Consolidated Electric Company, in the city, and to Wrightsville Beach lines operated by the MacRae interests.

VALLEY CITY, N. D.—At an election held recently the citizens voted to sell the municipal electric lighting plant. A bond proposition for

increasing the efficiency of the plant in case the people decided to keep the plant in operation was also carried. Owing to lack of proper equipment and mismanagement the inferior service given by the plant caused the decision to sell.

AKRON, OHIO.—Plans are under way for the consolidation of the Northern Ohio Traction & Light Company, of this city, and the Cleveland, Painesville & Eastern Railroad, of Willoughby, which are both owned by Henry A. Everett and E. W. Moore and their associates of Cleveland.

CINCINNATI, OHIO.—The Springfield, Wilmington & Cincinnati Railway Company has filed a mortgage for $4,000,000 in favor of the Knickerbocker Trust Company to secure a bond issue of like amount. The company proposes to build an electric railway between Cincinnati and Springfield.

COLUMBUS, OHIO.—The Sprague Electrical Company has secured the contract to install the electric light system at Tuscarora Park at New Philadelphia.

COLUMBUS, OHIO.—F. C. Caldwell, professor of electrical engineering, and Embury A. Hitchcock, professor of experimental engineering of the Ohio State University, will make a test of the municipal electric lighting plant to determine whether the present machinery is adequate to carry its present load and 300 more arc lamps, before the Board of Public Service contracts for additional machinery, which will cost $90,000.

MASSILLON, OHIO.—In return for extending its electric railway to a town about three miles distant from this city the Northern Ohio Traction & Light Company has received an extension of eight years to its franchise in this city, making the franchise run 25 years from the present time.

MASSILLON, OHIO.—The County Commissioners have granted the Canton-Akron Consolidated Railway Company, affiliated with the Northern Ohio Traction & Light Company, a franchise for a line between this place and Greenville.

MECHANICSBURG, OHIO.—The Mechanicsburg Telephone Company has increased its capital stock from $35,000 to $50,000.

PAYNE, OHIO.—The Payne Home Telephone Company has increased its capital stock from $15,000 to $25,000.

TOLEDO, OHIO.—The stockholders of the Toledo Railways & Light Company will meet on June 15 to vote on the acquisition of the Toledo Gas, Electric & Heating Company and the increase of capital stock from $12,000,000 to $15,000,000.

OKLAHOMA, OKLA.—The addition to the Lee Hotel building, which is to be erected, will contain a power plant to furnish electricity for light, heat and other service to the hotel building and to other buildings in that vicinity. The Robert B. Orr Engineering Company, Kansas City, Mo., is said to be preparing plans for the plant.

ASTORIA, ORE.—The City Council has granted a franchise to Messrs Adair and McFarland to build and operate an electric railway between Astoria and Fort Stevens. The franchise is for a term of 30 years.

PENDLETON, ORE.—Preparations are being made by the Walla Walla Traction Company for the construction of two sub-stations, one to be erected at Milton and the other at Freewater.

ROSEBURG, ORE.—At an election held recently the citizens voted to amend the city charter, authorizing the City Council whenever they may deem it necessary to call a city election to vote on the question of issuing bonds to install water and lighting systems at a cost not to exceed $250,000.

HARRISBURG, PA.—The Governor will be asked to grant a charter on June 1 to the Palmyra & Campbellstown Electric Street Railway Company to build a line five miles long between these two points. The incorporators are: Harry Baum, F. R. Dissinger and L. Raymond Riegert.

HUGHESTOWN, PA.—The Town Council has passed the ordinance granting a franchise for the use of Parsonage Street to the Pittston & Avoca Street Railway Company.

LEBANON, PA.—The Lebanon Valley Street Railway Company plans to extend its system from Avon to Schaefferstown, a distance of six miles.

LEBANON, PA.—Application has been made by George B. Stucker, P. L. Grubb, Alfred and Henry Snavely for a charter for the Lebanon & Bismarck Street Railway Company, which purposes building a line from Lebanon to Mt. Gretna, via Bismarck.

LEWISTOWN, PA.—An application is about to be made for a charter for the Lewistown Light, Heat & Power Company. The incorporators are H. Laussat Geyelin, F. King Wainwright and William Innes Forbes.

NEW CASTLE, PA.—The Pittsburg, Butler, Harmony & New Castle Street Railway Company has filed a charter for extensions to its line to be made in Evans City and Ellwood City.

PHILADELPHIA, PA.—The Town Council of Phoenixville has been asked to grant a franchise to the Philadelphia Interurban Railway Company for forming the Royersford Street Railway Company to build a street railway over certain streets of that town. The plans of the company provide for the construction of a road from Phoenixville to this city by the way of Berwyn.

POTTSTOWN, PA.—The Pottstown & Reading Street Railway Company will install the Ramsey block signal system along its line.

SOUTH BETHLEHEM, PA.—The South Mountain Traction Company, composed of local capitalists, has asked for a charter to build a line between the western limits of South Bethlehem and the eastern limits of Northampton Heights.

YORK, PA.—Burgess Martin has signed the ordinance passed by West York Town Council granting a franchise to the Hanover & York Street Railway Company for a line on King Street. The ordinance granting the York Street Railway Company a franchise on West Market Street was passed on the same ballot with the Hanover & York Company's franchise.

YORK, PA.—York capitalists are interested in a project to connect this city, Lewisberry, Lisburn and New Cumberland by an electric railway, which would make a continuous electric road between York and Harrisburg. Preliminary surveys for the new line have been made, and electricity for operating the road will be furnished by the York Haven Water & Power Company.

HENDERSON, TENN.—At an election held recently the citizens voted to issue bonds for an electric lighting plant. The City Council is said to be considering the proposition of purchasing the local electric plant and will greatly enlarge and improve the same.

CLEBURNE, TEX.—Application has been made to the City Council for a franchise to build and operate a street railway over certain streets of the city. W. L. Martin is interested in the enterprise.

ROYSE CITY, TEX.—The electric light plant of the Royse Milling & Light Company was recently destroyed by fire.

ROANOKE, VA.—The City Council has granted a franchise to the Roanoke Traction Company to build an electric railway in the southwest section of the city.

ROANOKE, VA.—The Roanoke Heat, Light & Power Company has awarded the contract for the construction of its new power house to H. G. and L. G. Dill, consulting and contracting engineers, of Washington, D. C. The building will cost about $25,000.

TULALIP, WASH.—Bids will be received by C. F. Larrabee, acting Commissioner of Indian Affairs, Washington, D. C., until June 12, for furnishing materials to construct and complete at the Tulalip School, Wash., dormitory, residence, hospital, warehouse, power house and electric lighting plant. For further information apply to Charles M. Buchanan, superintendent.

CAMPBELLSPORT, WIS.—W. L. Anderson has decided to construct an electric light plant here at once.

LODI, WIS.—George Bancroft, village clerk, writes that the citizens on April 9 voted to issue $7,000 in bonds for an electric light plant. No engineer has been selected. A temporary engineer is now making appraisal of the present plant.

MARSHFIELD, WIS.—The city of Marshfield has practically finished the power house for its new electric light and water works plant, and has now begun the installation of equipment. Concrete foundations have been prepared for supporting the Allis-Chalmers Reliance belted engines which will be used to drive two Allis-Chalmers alternating-current generators, one of 225-kw capacity, and the other of 100-kw. The engines are 14 in. x 30 in. and 18 in. x 42 in. respectively, and the generators are 60-cycle, 3-phase machines. Of these two units the smaller will be used to carry the day load, leaving the larger portion of the lighting load for the larger machine. Three new 150-hp boilers of the horizontal tubular type 72 in. x 18 ft. will generate steam for the operation of the station. In a sub-station, some distance away, the new pump will be installed seventeen feet below ground, by means of which water will be pumped into the stand pipe.

OSHKOSH, WIS.—F. H. Josslyn, of Oshkosh, a promoter of the Northern Hydro-Electric Company, writes that Daniel W. Mead, Chicago, Ill., is engineer for the proposed plant. Nothing definite has yet been done.

REEDSVILLE, WIS.—Charles Heim, village clerk, writes that contracts for the municipal electric light plant have been awarded as follows: Electrical machinery and generator to the Central Construction Company, of Oshkosh, for $933; for two 30-hp producer gas engines to the Columbus Machine Company of Columbus, Ohio, for $2,250; construction of power house to Duggan & Brenner, of Reedsville, for $1,940; triplex power pump to Gould Company, of Chicago, Ill., for $638; Smith's automatic gas producer to the Smith Gas Power Company, of Lexington, Ohio, for $1,400 and for wire to Julius Andre Company, of Milwaukee, Wis.

LARAMIE, WYO.—E. A. Phinney, of Ouray, Col., and J. A. Arbogast, of Waynesburg, Pa., have purchased the plant of the Laramie Light & Power Company. It is reported that the plants at Ouray and Laramie will be consolidated and the plant at Laramie will be improved and enlarged.

NELSON, B. C.—The West Kootenai Power Company has taken over the plant and property of the Cascade Power Company, which gives the company a total capacity of 30,000 hp.

WINNIPEG, MAN.—The Board of Control has recommended to the City Council that 100 additional street lamps and two regulators be purchased at an estimated cost of $4,500 for extension of the street lighting system.

NOTRE DAME DE GRACE, QUE.—The Saraguay Electric Light & Power Company, of Cartierville, has secured the contract for lighting the town for 10 years. The company agrees to install 100 Nernst lamps at $25 per lamp per year for single glower and $35 for double glower lamps.

Company Elections.

MANCHESTER, CONN.—At the annual meeting of the Manchester Light & Power Company held May 7, the company was reorganized and a new board of directors elected as follows: Arthur E. Bowers, H. O. Bowers, E. S. Ela, Dr. S. M. Bradley and Harrison B. Freeman, Jr. The directors have organized with the following officers: E. S. Ela, president; M. S. Bradley, secretary, and H. O. Bowers, treasurer.

ST. LOUIS, MO.—The directors of the West St. Louis Water & Light Company have re-elected the following officers for the ensuing year: John H. Bothwell, president; John F. Lee, vice-president; Wm. P. Kennett, secretary and treasurer; Wm. H. Lee, Charles E. Andrews, Thomas H. Francis and D. R. Francis, Jr., are the directors.

CAMDEN, N. J.—At a recent meeting of the stockholders of the South Jersey Gas, Electric Light & Traction Company the following directors were elected: David Baird, Thomas C. Barr, Frank Bergen, H. Blackwell, Frank O. Briggs, John J. Burleigh, Forrest F. Dryden, Col. A. B. Kuser, Rudolph V. Kuser, John D. Kuser, Thomas N. McCarter, Uzal H. McCarter and W. J. Thompason. The directors elected the following officers: Col. A. B. Kuser, president; John J. Burleigh, vice-president;; Frederick Evans, secretary;; Charles G. Cook, treasurer.

SUSSEX, N. J.—At a meeting of the Woodburne Electric Light, Heat & Power Company, held recently, the following officers were elected: Charles A. Wilson, president and general manager; Charles H. Crisman, vice-president; A. W. Bedell, secretary and treasurer; directors: C. A. Wilson, C. H. Crisman, John J. Stanton, Clarence T. Van Sickle, A. W. Bedell.

ALBANY, N. Y.—At the annual meeting of the Home Telephone Company held recently the following directors were elected: James Moore, T. Henry Dumary, William H. Keeler, Albert Hessberg, E. B. Toedt, Howard Hendrickson, Eli M. Woodard, Richard Stephens, Samuel B. Rawson, Irving H. Griswold, Theodore M. Brush, Frederick H. Sudro, E. F. Allen, E. E. Williams and Harry H. Bender.

CANTON, OHIO.—The Canton Electric Company, recently formed by the consolidation of the Canton Heat, Light & Power Company and the Central Heating & Lighting Company, has elected the following officers: Henry L. Doherty, of New York, N. Y., president; Richard E. Breed and Herbert T. Hartman, of Philadelphia, Pa., vice-presidents; Frank R. Bell, of Philadelphia, Pa., secretary and treasurer.

VERGENNES, VT.—At the annual meeting of the Vergennes Electric Company held May 11 the following officers were elected: Capt. C. E. Parker, president; E. S. Marsh, of Brandon, vice-president; Frank K. Goss, of Montpelier, secretary, and C. E. Parker, treasurer.

New Industrial Companies.

THE ACME ELECTRICAL CONSTRUCTION & SUPPLY COMPANY, of Chicago, Ill., has been incorporated for the purpose of carrying on an electrical and supply business. The company is capitalized at $10,000, and the incorporators are: John J. Williams, J. William Lundgren and Fred A. Wescott.

THE BELL ELECTRIC CONSTRUCTION, of New York, N. Y., has filed articles of incorporation with the Secretary of State, with a capital stock of $5,000. The directors are: A. C. Bell, T. R. Bell and Mary L. Bell, of New York, N. Y.

THE BELL ELECTRIC COMPANY, of Camden, N. J., has been incorporated, with a capital stock of $250,000, by William Bailey, Thomas Franklin Laurd and Joseph S. Swain.

THE GRADOLPH ELECTRIC COMPANY, of St. Louis, Mo., filed articles of incorporation, with a capital stock of $100,000. The incorporators are: William F. Gradolph, Charles A. Niel, Joseph Zerr, E. A. Wallemann and Mason K. Blake. The object of the corporation is to manufacture and deal in electric appliances, tools, etc.

THE McDONALD ELECTRIC SUPPLY COMPANY, of Alton, Ill., has been incorporated, with a capital stock of $5,000, by C. H. McDonald, F. T. McDonald and J. V. Marsh.

THE TOLEDO LIGHT & EQUIPMENT COMPANY, of Toledo, Ohio, has been incorporated for the purpose of manufacturing electric lamps. William C. Miller is president.

New Incorporations.

TUCSON, ARIZ.—Articles of incorporation have been filed for the Southern Telephone & Electric Company, with a capital stock of $10,000,000, by E. L. Swaine and others.

TRINIDAD, COL.—The Southern Colorado Power Company has been formed with capital of $10,000,000 for the purpose of purchasing all the electric lighting and power plants in southern Colorado. It is said that the company has options on all the properties of importance in this section of the state, including the Trinidad Light, Gas, Power & Railroad Company, which recently purchased the Las Animas Light, Power & Manufacturing Company.

CHICAGO, ILL.—The Rockford, Oregon & Southern Railway Company has been chartered, with a capital stock of $10,000, for the purpose of constructing an electric railway from Brooklyn, Ill., to Dixon. F. C. Jones is one of the incorporators.

LINCOLN, ILL.—The Lincoln Railway & Light Company has been chartered, with a capital stock of $2,500, by M. O. Payne and others. The company is successor to the Lincoln Street Car Company, which was reported recently to have been sold to W. R. Schott, of Chicago.

ANDERSON, IND.—Articles of association have been filed by the Central Indiana Lighting Company, with a capital stock of $3,000,000. William M. Wherry, Jr., John W. Tobin and Ivan L. Meloon, all of New York, N. Y., are the incorporators. The Central Indiana Company is a branch of the National Heat, Light & Power Company, of New York, N. Y. In Indiana the National Company, through the Central Lighting Company, has options on the lighting plants at Shelbyville, Columbus, Elwood and Fairmount.

BOSTON, MASS.—The Lord Electric Company, of Boston and New York, N. Y., has been incorporated, with a capital stock of $100,000, by Frederick W. Lord, Thomas P. Curtis and Robert H. Hallowell.

HARRISON, N. J.—The Light & Equipment Syndicate has been incorporated, with a capital stock of $150,000, by H. Warren Coster, Luke J. Le Rolle and Ray E. Bernstein.

JERSEY CITY, N. J.—The Williamsport Light Company has filed articles of incorporation with the Secretary of State, with a capital stock of $500,000. The incorporators are: Alfred Ely, Jacob Helma and William H. Carey.

PORTALES, N. M.—The Portales Water Works & Electric Light Company has been incorporated, with a capital of $15,000. The incorporators are: C. Howard, W. H. McDonald and J. Howard, all of Portales.

WILMINGTON, N. C.—The Tidewater Power Company has been organized here with Hugh MacRae, president, and P. M. Sheppard, secretary and treasurer.

BLOOMVILLE, OHIO.—The Bloomville Light & Heating Company has been chartered, with a capital stock of $10,000, by D. W. Fellers and others.

CINCINNATI, OHIO.—The Ohio Electric Railway Company has been incorporated with a capital stock of $100,000 by E. H. Berry, D. J. Downing, S. M. Murray, W. H. Schunert and C. Wilson.

FREMONT, OHIO.—The Fremont Street Railway Company has been chartered by A. H. Jackson, James Hunt, J. M. Sherman, J. J. Anderson, of Fremont, and R. G. Kerlin, of Toledo, to take over the local properties owned by the Kerlin Brothers. It is said that the owners are contemplating improvements and extensions to the property.

HALLETT, OKLA.—The Hallett Line Heating & Lighting Company has been incorporated with a capital stock of $80,000 by A. F. Wolf, Richard Geiger, of Fayetteville, Ark., and others.

COOS BAY, ORE.—The Coos Bay Gas & Electric Company has been organized with a capital stock of $250,000. The officers of the company are: Henry Hewitt, president; Seymour H. Bell, secretary and treasurer, and Edward Riggs, superintendent. The street lighting system consists of 45 arc lamps of 1200 cp with all-night service at $72.20 per lamp per year. The company furnishes electricity for commercial purposes at eight cents per kw-hour.

HARRISBURG, PA.—A charter has been granted by the state to the Clark's Summit & Lake Winola Street Railway Company for a term of 99 years. The capital stock is $48,000, and the directors: Thomas B. Rodham, president; William L. Allen, J. D. Keator, C. A. Keller and Frank P. Benjamin. The line will be eight miles long, extending from Clark's Summit to Lake Winola.

PITTSBURG, PA.—The Waynesburg & Washington Street Railway Company has been formed to build a traction system down Ten Mile Creek into Washington County and to the Monongahela River at Millsboro.

WAGNER, S. D.—The Armour Traction Company has been organized by local men to build and operate an electric railway from Armour to Mitchell, a distance of 65 miles. The capital stock is $1,000,000, and the headquarters of the company will be at Armour. E. P. Wanzer is one of the incorporators.

Educational.

MASSACHUSETTS INSTITUTE OF TECHNOLOGY.—Prof. H. E. Clifford, of the electrical engineering department, will next year extend his notable lectures on alternating currents into a graduate course. These lectures have hitherto been restricted to the required work in alternating currents of the undergraduate students, but during the next college year Prof. Clifford will deliver an advanced course which will be particularly intended for graduate students who are attending the Institute for the purpose of spending a fifth year in the engineering school, or for the purpose of their obtaining a second degree. These lectures are expected to be among the most brilliant and complete that have yet been presented on the subject in any of the engineering schools of America.

Legal.

WHERE THE QUESTION OF THE PRESENCE OF INVENTION IS DOUBTFUL.—The courts have generally found it inadvisable to attempt to define invention, and, concluding that there are no affirmative rules by which to determine its presence or absence in every case, have recognized and applied certain negative tests to establish the want of invention. But where, upon the application of these tests, the question of invention is still left in doubt, such doubt may be resolved in favor of the patent by evidence of successful results where others have failed. American Graphophone Co. vs. Universal Talking Mach. Mfg. Co., United States Circuit Court of Appeals, 151 Fed. Rep. 595.

COMPELLING PERFORMANCE OF CONTRACT NOT TO MANUFACTURE ELECTRIC CONTROLLERS.—About March 31, 1896, the General Electric Company entered into a contract with the Westinghouse Electric Company, which was to continue and be in force for a term of fifteen years, and under which each company released the other from all claims for damages for past patent infringements and licensed the other to use its patents. It was stipulated, however, that the Westinghouse Company should purchase all the electrical controllers or brakes used or sold by it from the General Company, which owned the patents therefor, and the Westinghouse Company agreed not to manufacture the same or others of similar type except in event of the failure of the General Company to supply the controllers and brakes according to the terms of the contract. On its part the General Company agreed to purchase overhead trolleys exclusively from the Westinghouse Company. In an action by the General Electric Co. against the Westinghouse Company, brought for the purpose of enforcing the contract, the plaintiff company alleged that, while it had complied with and kept and performed its agreement and had expended large sums of money in a manufacturing plant and facilities with which to supply the reasonable requirements of the defendant company, with regard to controllers, the latter company was engaging in the manufacture of electric controllers and asserting its right to continue with such manufacture, in contravention of the terms of the contract and in violation of the plaintiff's patent rights. It was held that, the plaintiff having, in reliance upon the contract, abandoned the manufacture of trolleys, incurred large expense in preparing for the manufacture of controllers, and having lived up to its side of the contract, was entitled to an injunction restraining the defendant company from manufacturing controllers. General Electric Company vs. Westinghouse Electric Company, United States Circuit Court, N. D. New York, 151 Fed. Rep. 664.

DUTY OF ELECTRICAL COMPANY TO FURNISH EMPLOYES WITH SAFE PLACE IN WHICH TO WORK AND WITH SAFE APPLIANCES.—The plaintiff served in the defendant company's employ in the capacity of lamp trimmer, and his action against the company was brought for the purpose of recovering damages for the effects of an electrical shock which he received in the course of his duties. One of the defendant's electric light poles was erected so near to an iron awning rail that one would necessarily come in contact with the rail while climbing the pole. Just prior to the accident the plaintiff had ascended the pole for the purpose of lowering the arc light by means of the revolving drum attached to the pole. As a result of many previous raisings and lowerings the wires which suspended the arc light, by rubbing against a heavily charged primary wire which was strung on the pole, had broken the insulation upon the latter. The current was thus conducted down the supporting wires to the drum which the plaintiff had in his grasp and through the plaintiff's body to the ground by way of the iron awning rail. There was evidence that if the awning had not been in contact with the plaintiff's body he would have received a shock, but one less severe than that which he did receive. It was held that the question of the defendant's negligence was one for the jury and the jury found that the injury would not have occurred but for the fact that the heavily charged wire was run underneath the wires supporting the lamp in such a manner as to allow them to rub when the lamp was raised or lowered, and that the pole was placed so near the awning as to render the plaintiff likely to come in contact with it while engaged at his work. A verdict was brought in for the plaintiff. It is well established that an employer of labor is required, in the exercise of proper care, to provide for his employees a reasonably safe place in which to work and to supply them with machinery, tools and appliances reasonably safe and suitable for the work in which they are engaged. Horne vs. Consolidated Railways Light & Power Company, Supreme Court of North Carolina, 57 S. E. Rep. 19.

Obituary.

MR. GEORGE H. COLE, supervising architect for the Southern Bell Telephone & Telegraph Company, died in Atlanta on May 10 of pneumonia. He was born in Westport, N. Y., on Nov. 24, 1838, and was connected with the Southern Bell Telephone & Telegraph Company for 22 years. He was actively engaged at his usual vocation up to within one week of his death. Prior to his connection with the telephone company, he was associated with the Western Electric Company, and was engaged with it in the development of the earlier forms of telephone and telegraph apparatus. He was a man of great versatility and highly esteemed by his associates.

SIR B. BAKER.—The death is announced in England on May 19, of Sir Benjamin Baker, well known in civil, mechanical, electrical and other engineering circles. Sir Benjamin Baker, who was born in 1840, was one of the great engineers of the world. He invented the pneumatic shield, which has rendered so much assistance in tunnelling under rivers. The two engineering works by which he will be best remembered are the Forth Bridge in Scotland and the Assouan Dam. Eiffel, the French engineer, declared the former "the greatest construction in the world." It is 2765 yards long and cost $15,000,000. It is built on the cantilever principle and its main spans are each 100 feet longer than the main span of the Brooklyn Bridge. Its steel towers, 360 feet high, give 151 feet headway above the Forth at high water. The Assouan Dam also cost about $15,000,000. It is a mile and a quarter long, and raises the level of the Nile sixty-seven feet. The dam is 120 feet high, and varies in thickness from 82 to 26 feet. Behind it, in a lake of 140 square miles, is stored water sufficient to insure the irrigation of the Delta in the dryest seasons.

MR. C. H. HASWELL.—We note with deep regret the death of Mr. Charles H. Haswell, which occurred in New York City last week, nearly in the ninety-eighth year of his age, his birthday being May 22, 1809. This distinguished engineer received a classical education, but his tastes were wholly mechanical, and when, after previous experience he entered the U. S. Navy, he became its first chief engineer. He did notable work for the department but left it in 1850, and for more than 40 years was an insurance surveyor of steamships. He was also, up to almost the last moment of his life, in active service in the engineering department of the Board of Apportionment of New York City. Some idea of his vitality may be formed from the fact that about ten years ago he took up bicycling as an exercise. He was the author of the famous "Haswell Pocket Book" for engineers, which has had a wonderful circulation in some sixty editions. He was also the author of an extremely interesting book of "Reminiscences of an Octogenarian" full of anecdotes of old New York. He was a honorary member of the American Society of Civil Engineers, and an honorary member of the American Society of Mechanical Engineers, as well as a valued member of the Institution of Civil Engineers. He and Mr. Carnegie were the only honorary members of the Engineers' Club, a social body in whose house and pleasant reunions he took great pleasure. It is also worthy of note that at the time of his death he was the oldest living member of Tammany Hall. He voted for fifteen Presidential candidates of the Democratic party, and Mr. Hearst, for Governor, was the first ticket of his party he had ever bolted. "That was the limit," he said, when he supported Governor Hughes instead.

MR. C. F. CUTLER, president of the New York & New Jersey Telephone Company, died suddenly of heart disease at Saranac Lake, N. Y., while on a fishing trip, on May 18. Mr. Charles Frederic Cutler was born in Ashland, Mass., in 1841. He began business as a young man in South Framingham, Mass., as a commission merchant, traveling through the West buying grain. He became interested in the telephone business in New England and then went to Brooklyn, where he formed the New York & New Jersey Telephone Company, of which he was made president. He then came to New York and joined the Metropolitan Telephone & Telegraph Company, afterward the New York Telephone Company. At the time of his death he was president of the New York Telephone Company and chairman of the board of directors of these companies: The New York & New Jersey Telephone Company, the Bell Telephone Company of Philadelphia, the Delaware and Atlantic Telegraph and Telephone Company, the Chesapeake & Potomac Telephone Company, the Hudson River Telephone Company, the Central New York Telephone & Telegraph Company, the Empire State Telephone & Telegraph Company, and the New York & Pennsylvania Telephone & Telegraph Company. He was known all over the United States as a man of unusual business ability, and probably did as much as any other one man to develop the telephone interests of the country. The growth of the New York system under his management has been one of the marvels of the industry. He was also connected with several banks and banking institutions. He leaves a widow, Ella Poole Cutler, and two children—a daughter, Mrs. James B. Curtis, and a son, Earle Newton Cutler, 18 years old, who is a student at St. Paul's School, Concord, Mass. As a mark of respect to his memory, the executive and general offices of the New York Telephone Company and the New York & New Jersey Telephone Company were closed at noon on Tuesday, May 21, the day of the funeral.

MR. C. K. STEARNS.—We regret to note the death of Mr. Charles K. Stearns, electrical engineer, of Boston, Mass. He was born at Newton Centre, Mass., in 1864. He was a son of the late Professor O. I. Stearns of Newton Theological Institution. He was educated in the Newton public schools and at the Massachusetts Institute of Technology. Devoting himself to electrical engineering, he was engaged by the Thomson-Houston Company at Boston, and later in its St. Paul (Minn.) office. He was an assistant engineer in electrifying the Nantasket branch of the N. Y., N. H. & H. R. R., and during his later years had continued in similar lines of work with street railways and electric development of water powers. He was a member of the American Society of Mechanical Engineers and of the American Institute of Electrical Engineers. He was honored and loved by all his business associates, as well as in the intimate circle of his home. He leaves a widow, daughter of I. V. H. Hunter of Boston, a sister, Mrs. H. H. Kendall of Newton Centre, and a brother, William O. Stearns of Hamilton, N. Y. A personal and intimate friend of Mr. Stearns writes us: "In Charles K. Stearns, the engineering profession loses one of the kind of men it can ill afford to lose; one of the men who combined in

a rare degree the result of technical training, practical experience, and the sterling integrity which would allow of 'serving two masters,' or being 'influenced' against his employers' interests as easily as the Bartholdi statue could be coaxed off its pedestal. In private life and in his work, the keynote of every action might fittingly be expressed in the two words, thoroughness and sincerity. In commercial electrical engineering, especially as applied to railroad methods and economics, many a detail of design and construction now accepted as 'standard' is due to his ingenuity and initiative, though lacking the credit and publicity that would have been claimed and nurtured by one more desirous of basking in the limelight of 'professional appreciation.' With a heart as tender as a woman's in family and personal relations, but with a conservative and coolly analytical judgment, inherted from good old New England Puritan stock, his was a rarely balanced temperament, equally ready with sympathy and counsel for those in need of it, or for summary action to enforce the performance of an agreement once entered into, without regard to personal convenience or comfort. Many a struggling salesman and contractor has good reason to remember his readiness to 'help out' on a genuine error, or unfortunate business condition for which he was not responsible, but the 'shirk' or 'quitter' found him inexorable, as the record of many a railroad and power and lighting system will bear silent evidence to-day. To his friends, a friend of friends; to his employers, a faithful servitor; to his business associates, a rare exponent of the 'square deal' in business relations; and to all who knew him, a gentleman; broad in all that liberality to others means, and narrow in the performance of self-manifest duty; such was the character of Charles K. Stearns."

Personal.

MR. LAMAR LYNDON, consulting engineer, has moved his offices from 80 William Street to 2 Rector Street.

MR. GEORGE FLETT, the managing director of Dick, Kerr & Co., the electrical and street railway manufacturers and contractors, of England, arrived on Sunday by the *Amerika* on a brief trip.

DR. OTTO FEUERLEIN, of the Siemens & Halske Company, of Berlin, arrived last week in New York on a short visit to this country. Dr. Feuerlein has been here before and has already a large circle of acquaintances in America.

MR. GEO. W. MARTIN, for two years associate editor and for the past year editor of *The Electrical Age*, resigned his position with that journal on March 15 to accept a position in the engineering department of the New York Edison Company.

MR. W. McA. JOHNSON.—Mr. Woolsey McA. Johnson, the expert electrochemist and metallurgical engineer, has just returned from a four days' inspection of the Kelly mine of the Tri-Bullion Smelting & Development Company, in New Mexico. This is a very promising zinc property.

PROF. H. T. BOVEY.—Dean Bovey, the energetic head of the Faculty of Physics, McGill University, Montreal, is already working hard on plans of restoration of equipment and on a new library for the new engineering building of the university. He is expected to visit the United States during the next few weeks.

MR. W. L. WATERS.—As the National Electric Company, of Milwaukee, is giving up the manufacture of electrical machinery, Mr. W. L. Waters, who has been chief engineer of the company since it first took up the manufacture of electrical machinery in 1901, has decided to sever his connection with the company. Mr. Waters will spend the summer in Europe taking a well-earned rest before taking up active work again.

DR. E. ROSENBERG, of Berlin, Germany, is visiting the United States for the first time, and will spend five or six weeks in a tour of manufacturing plants, power stations, etc. He has been interested in the development of a very interesting line of small direct-current generators, treated quite full in the Electrical World last November, and which has been developed in Europe by the Allgemeine Elektricitaets Gesellschaft for train lighting, etc.

DR. A. G. BELL.—Dr. Alexander Graham Bell, who went to England last month to get the degree of Doctor of Science from Oxford University, returned this week with his wife on the Hamburg-American liner *Amerika*. Dr. Bell and his wife spent most of their time in England motoring, and the inventor declared that he had made one discovery in England, and he announced it with sorrow, and that was that English motor cars were superior to those of American make.

MR. J. R. CRAVATH, Western editor of the Electrical World, had a very interesting article in *The World To-Day*, of Chicago, on "The Truth About Municipal Ownership." Mr. Cravath has visited and inspected and described a great many private and municipal plans of late years, and his discussion of the subject is, therefore, that of a competent critic, writing without bias or prejudice. He expresses a belief in better conditions in the future for lighting plants, but all his observations in the field incline him to favor private corporations wherever they can and will give reasonable rates and good service. The article is a valuable and timely contribution to a most important controversy.

MR. W. S. MAYER.—Mr. Walter S. Mayer, who for a number of years had charge of the engineering department of the Cutter Electrical & Manufacturing Company, of Philadelphia, has resigned to become general manager of the Machen & Mayer Electrical Manufacturing Company, of Philadelphia, which will manufacture flush push button switches, rotary flush switches, snap switches, automatic door switches, pendant switches, flush plugs and receptacles and other electrical specialties, designed and patented by Mr. Mayer, who is an able designer of electrical apparatus. Besides his designs and patents for the above specialties, Mr. Mayer has a great many of the most practical and useful patents, covering automatic circuit breakers, standing in his name.

MR. H. J. GILLE, manager of the commercial department of the St. Paul Gas Light Company, and who has been with the company in different capacities for the past nine years, leaves the St. Paul field June 1 to take the position of commercial manager of the General Electric Company in Minneapolis. He first became connected with the St. Paul company in April, 1898. Mr. Gille is prominently known in the electrical and gas field, and friends and admirers in St. Paul will be sorry to lose him. He has been longer identified with lighting interests than any one now in the city. He has also served as director and member of prominent committees at the Commercial Club, and his influence was always felt for the advance of the city. With Dr. A. W. Miller he constructed the first alternating-current dynamo built in Minnesota, and has patented a number of important and much-used electrical devices. His activities have not been confined to Minnesota. After beginning with the Acme Electric Company, and then with the Columbia Electric Company, where he was in charge of its supply department from November, 1889, until June, 1891, he advanced to assistant purchasing agent and manager of supply department of the Northwest Thomson-Houston Electric Company, being made purchasing agent and manager in July, 1892. His appointment an assistant manager of the supply department of the General Electric Company, at Chicago, in October, 1894, meant experience in a broader field. After being with the General Electric Company until 1895, he was appointed engineer in the electric department of the Washburn & Moen Manufacturing Company with headquarters in St. Paul, and in this capacity traveled as electrical engineer over the entire West, gaining a wide personal acquaintance. In April, 1898, he was appointed superintendent of the electric department of the St. Paul Gas Light Company and the Edison Electric Light & Power Company, and in July, 1902, was made general superintendent and purchasing agent. During the time he was with the company the electric plants and distribution system were entirely rebuilt and improved. He is now president of the Minnesota branch of the American Institute of Electrical Engineers, a member of the National Electric Light Association, Northwest Electric Light Association and American Gas Institute. Mr. Gille is a native of Minnesota, having been born in that State 37 years ago.

Business Notes.

THE CENTURY ELECTRIC COMPANY, St. Louis, has established its New York office at 232 Fulton Street.

THE ELECTRIC SERVICE SUPPLIES COMPANY has moved its New York office from 85 Liberty Street, to the United States Express Building, 2 Rector Street.

THE PAGE ELECTRIC COMPANY, of Worcester, Mass., has purchased the business of Plummer, Ham & Richardson, electrical contractors and dealers in general electrical supplies, in that city. For the present the two companies will be run independently. John P. Coughlin is treasurer of the Page Electric Company.

MR. A. F. RICHARDSON, of Worcester, Mass., who recently sold out all but the manufacturing end of his business to the Page Electric Company, will soon take possession of the second floor of the Stevens Block, where he will carry on all kinds of motor and generator work, armature winding and telephone business. Mr. Richardson will retain his office in Providence.

NEW LUNKENHEIMER STORE.—The Lunkenheimer Company, Cincinnati, Ohio, has established its Eastern office and warehouse in much more commodious quarters, in the building at 66-68 Fulton Street, New York, recently erected, Alfred J. Jupp managing this division of the company's business. In making provision for adequate stock from which to supply the Eastern and Atlantic Coast trade easily and quickly, it was necessary to use to best advantage the space occupied, and by somewnat unique methods prepare for the accommodation of a large assortment as well as sufficient quantities, so arranging the irregular floor space as to have it attractive in appearance. The building fronts on Fulton Street and there is a narrower street on the westerly side. The dimensions approximately of the man floor are 35x80x20 feet. The problem was to utilize such an irregular space so as to combine an office with the necessary shelving for many kinds of goods, and yet secure harmonious results. In planning a total 1400 bin spaces, all 2 feet deep and 4 feet wide, there being a lower tier and upper gallery in a room with a 13-foot ceiling. Some conception of the comprehensive stock carried at this depot is afforded by a mention of the principal classes of goods made by this company. There are valves for steam, water, gas and oil; lubricating devices for ordinary gravity and pressure systems, including cylinder and bearing lubrication, and complete stock of grease cups and mechanical lubricators for marine and stationary service. There are also mechanical lubricators for auto and high power motor boats, likewise a comprehensive line of specially designed cocks and fittings for gasoline piping, which the management believes is the largest assortment of kindred goods carried in New York. In valves there is a stock of bronze goods for high pressure marine service and a complete line of lubricating devices for gas engines and air compressors.

Weekly Record of Electrical Patents.

UNITED STATES PATENTS ISSUED MAY 14, 1907.

(Conducted by Rosenbaum & Stockbridge, Pat. Atty's, 41 Park Row, N. Y.)

853,216. METHOD OF AND APPARATUS FOR MEASURING ELECTRIC CURRENTS; Otto T. Blathy, Budapest, Austria-Hungary. App. filed Aug. 10, 1905. A form of electric meter having a rotatable element in a magnetic field, and means for causing the field intensities to be proportional to the current over any desired range. Has a magnetic bridge made of nickel, cobalt or some paramagnetic alloy.

853,218. ELECTRIC MOTOR; William M. Bradshaw, Wilkinsburg, Pa. App. filed Feb. 1, 1905. A means for transforming alternating current electrical energy into mechanical energy. Has a magnetizable core comprising two aligned polar projections with opposing faces and a main polar projection which differs in polarity therefrom.

853,219. TERMINAL BLOCK FOR ELECTRICAL APPARATUS; William M. Bradshaw, Wilkinsburg, Pa. App. filed Apr. 28, 1906. Relates to windings and terminal blocks for electrical translating devices. Provides a convenient and compact structure and arrangement of the windings and terminal blocks.

853,220. ELECTRIC SWITCH; William M. Brown, Johnstown, Pa. App. filed Feb. 20, 1905. Provides a switch structure operated by a single handle for controlling the battery connection of the series and shunt coils of a car wiring system.

853,231. MULTIPLE SOCKET FOR INCANDESCENT LAMPS; Elias L. Elliott, New York, N. Y. App. filed May 18, 1906. A cluster lamp socket or receptacle composed of an hemispherical translation block having threaded shells therein and having a central conical shell constituting a common central stud connection for all the lamps.

853,241. STEP-BY-STEP ELECTRIC SEAM WELDING APPARATUS; Hugo Helberger, Munich, Germany. App. filed Sept. 19, 1906. A welding machine having means whereby longitudinal welding seams or unions may be made between sheets of metal. Employs electrodes having compact faces forming passages, and negative electrodes in opposition to each other and movable toward and from one another to clamp or release the work therebetween.

853,263. COOLING SYSTEM; Karl C. Randall, Edgewood Park, Pa. App. filed May 2, 1906. A means for automatically regulating the amount of energy utilized for cooling electrical apparatus. Regulates the amount of cooling fluid admitted to the system according to the temperature of the apparatus to be cooled.

853,283. COMMUTATOR; William L. Waters, Milwaukee, Wis. App. filed Mar. 10, 1904. A construction of long commutator for electric motors in which a plurality of brushes are used, as in electroplating dynamos. The commutator is made in sections and provision is made for a free circulation of air therebetween.

853,285. DYNAMO ELECTRIC MACHINE; William L. Waters, Milwaukee, Wis. App. filed Sept. 5, 1905. A construction of rotor where the diameter is large so as to produce great centrifugal forces and strains at the poles. Relates to mechanical features of construction by which the windings are adjusted and clamped in place on the polar projections.

853,286. TELEPHONE TRUNKING SYSTEM; Harry G. Webster, Chicago, Ill. App. filed Aug. 1, 1902. Relates to details of cord circuits of a telephone exchange.

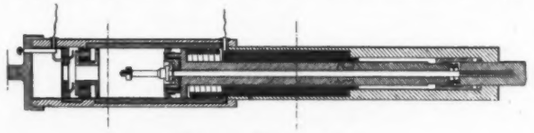
853,287. SUPERVISORY SIGNALING SYSTEM; Harry G. Webster, Chicago, Ill. App. filed Sept. 19, 1903. Relates to modifications of the above.

853,291. TELEPHONE SYSTEM; Garrison Babcock, Chicago, Ill. App. filed July 17, 1903. In a telephone system, the combination with a central exchange of a permanently continuous telephone line extending therefrom, a plurality of subscribers connected with said line, means whereby the exchange operator may selectively signal any one of said subscribers, means whereby any subscriber may independently signal the exchange operator, and means whereby any subscriber may selectively signal any other of the party subscribers independently of the exchange operator, substantially as described.

853,292. CIRCUIT-CHANGING APPARATUS; Jules A. Birsfield, Rochester, N. Y. App. filed March 22, 1905. Mechanical features of construction of a telephone relay.

853,296. ELECTRIC FUSE OR CUT-OUT; Leonard B. Buchanan, Woburn, Mass. App. filed Aug. 22, 1904. In case a fuse blows out an indication is made by a spring blade which is normally tied to the fuse wire, but which is released to be impelled outward by the melting thereof.

853,301. DEVICE FOR CONTROLLING THE OUTPUT OF A GENERATOR; Ethelbert T. Ford and William F. Bauer, St. Louis. Mo.



853,552—Electric Tool.

App. filed Aug. 9, 1906. A means for regulating the output of a generator or dynamo of the type designed to be driven by the car axles of a train and to rotate in different directions and at different speeds. A pole changing switch is frictionally clamped on the armature shaft.

853,304. TELEPHONE EXCHANGE SYSTEM; Arthur B. Kahl, Rochester, N. Y. App. filed Jan. 31, 1906. In a telephone system, the combination with a central exchange, of telephone lines leading therefrom and terminating in substations, a cord circuit at the central exchange for connecting subscribers for conversation, a source of ringing current at the central exchange, a relay for controlling the connection of said source with the cord circuit, and a second relay for controlling the circuit through said first relay, each of said relays directly controlling the continuity of the cord circuit.

853,305. CIRCUIT-CHANGING APPARATUS; William Kasling, Chicago, Ill. App. filed Nov. 23, 1903. In a device of the class described, the combination with a magnet of an armature adapted to swing between the poles thereof, means for polarizing said armature, and braking means for retarding the actuation of said armature when it is polarized in one direction, and for releasing said armature when polarized in reverse direction.

853,309. LOW WATER ALARM; Clarence A. Lemen, Detroit, Mich. App. filed July 22, 1905. A form of thermometer has its bulb projecting into the steam trap so that in case of low water, the temperature rises and impels the mercury upward to close a circuit with a platinum wire fused in the glass.

853,314. COMBINED CIGAR CUTTER AND LIGHTER; Phil J. Nawn, St. Louis, Mo. App. filed Mar. 12, 1906. A rotary cigar cutter has an arm which contacts with a sparking device so as to operate the igniter simultaneously with the cutting mechanism.

853,322. TROLLEY HARP; Edward D. Rockwell, Bristol, Conn. App. filed May 7, 1906. A form of trolley harp designed to protect the harp and its wheel against breakage or damage from rough usage. The harp casting has a yielding connection with the trolley pole.

853,333. COIL CLAMP FOR ROTARY MAGNETS; Charles A. Beckstrom, Milwaukee, Wis. App. filed Mar. 28, 1904. A means for binding the coils in place on a rotary magnet. Has a set of clamping members which are formed to bear against two sides of a magnet coil, a set of wedges between the clamping members, and means for

853,618—Circuit Closing Device.

actuating the wedges to press the clamping members against the respective coils.

853,337. BREAST-TRANSMITTER; Jules A. Birsfield, Rochester, N. Y. App. filed Feb. 13, 1905. In a telephone transmitter, the combination with a rear inclosing wall of a front inclosing wall consisting of two stampings, flanges extending from said stampings and separated to form an annular groove, and a flange extending from the rear wall for engagement in said annular groove.

853,340. WINDING FOR ELECTROMAGNETS; William M. Bradshaw, Wilkinsburg, Pa. App. filed Apr. 28, 1906. A form of winding of large current capacity for U-shaped magnet cores designed to occupy a small amount of space and to be easy and inexpensive to manufacture. Comprise a loop and bar that extends from one side of the loop partially across the area included thereby.

853,351. ELECTRIC BRAZING MACHINE; Weston M. Fulton, Knoxville, Tenn. App. filed Aug. 11, 1905. A brazing machine adapted to brass tubing, and also adapted for brazing the overlapping edges of metal plates. Has jaws which form terminals of a local transformer circuit.

853,352. PORTABLE BATTERY LAMP; Stephen W. Gibbs, Jr., Frankfort, Ky. App. filed June 5, 1906. A music support having an overhanging upper edge beneath which is placed a miniature electric lamp in circuit with a dry battery.

853,370. SPRING-JACK FOR TELEPHONE SWITCHBOARDS; Frank R. McBerty, Evanston, and Edward B. Craft, Chicago, Ill. App. filed Dec. 10, 1904. Mechanical details of construction.

853,374. SYSTEM OF DISTRIBUTION; Karl C. Randall, Edgewood Park, Pa. App. filed May 2, 1906. A transformer having star-connected secondary coils, and delta-connected auxiliary coils.

853,375. COOLING AND VENTILATING SYSTEM; Karl C. Randall, Edgewood Park, Pa. App. filed May 2, 1906. A regulator for controlling the cooling fluid of a transformer. The pump is driven by a motor which has its speed varied according to the cooling requirements.

853,389. TELEPHONE CALLING OR SIGNALLING DEVICE; Klas Weman, Buffalo, N. Y. App. filed Dec. 20, 1905. In a device of the character described, the combination of a core carrying two helices, a soft iron bar having an arm extending parallel over one helix and a permanent armature magnet lying over the other helix and engaging said arm and means for regulating the intimacy of contact between said armature and arm, said means comprising a bracket supporting jointed rod secured to said armature, and a helical spring surrounding a portion of said rod.

853,403. ELECTRIC BLOCK SYSTEM FOR RAILWAYS; Walter R. Fuller, Atlanta, Ga. App. filed Jan. 19, 1907. A special trolley wire is clamped alongside the usual track rails opposite the web thereof and a specially constructed depending arm from the locomotive makes a circuit therefrom.

853,444. HANGER FOR INCANDESCENT LAMPS; Maximillian J. Diemmer, Augusta, Ga. App. filed Feb. 26, 1906. A hemispherical casing receives a wire from which depends a flexible cord having an incandescent lamp thereon. The circuits are made by roller brushes engaging a stationary ring.

853,453. TROLLEY RETRIEVER; Madison F. Hodge, Leavenworth, Kans. App. filed Dec. 18, 1905. The trolley cord is connected to a spring reel and a rewinding spring is normally held against movement by a ratchet. In case of undue rapid movement of the cord a centrifugal device becomes effective to clutch the spring into action.

853,464. COMMUTATING ELECTRIC MOTOR; Ralph D. Mershon, New York, N. Y. App. filed Feb. 15, 1904. In a commutating electric motor, the combination with the stationary and moving elements thereof, and a source of current, of means for varying the number of poles in both elements, and means for short-circuiting the winding or windings in one of the elements, as set forth.

853,465. INDUCTION MOTOR AND GENERATOR; Ralph D. Mershon, New York, N. Y. App. filed May 28, 1906. In an alternating current machine of the induction type, the combination of a primary element, a rotating secondary element, and a rotating electrolytic condenser or condensers connected with the secondary winding or windings, as set forth.

853,491. SINGLE-PHASE ALTERNATING-CURRENT MOTOR WITH COMMUTATING POLES; E. Arnold, Karlsruhe, Germany, etc. App. filed Oct. 9, 1905. A single-phase alternating-current motor with a compensation winding lying in slots in the main poles and having the same ampere-turns as the portion of the armature winding under these poles and with commutating poles carrying two windings one of which in series and the other shunt excited, substantially as described.

853,475. ELECTROMAGNETIC MACHINE OR CONCENTRATOR; John H. Ryan, Portland, Ore. App. filed July 14, 1904. The ore particles fall over the surface of a succession of revoluble magnetic poles by which the magnetic particles are successively separated from the non-magnetic particles.

853,492. PROCESS AND DEVICE FOR CONTROLLING ELECTRIC CIRCUITS; Heinrich Beck, Meiningen, Germany. App. filed Jan. 27, 1906. An iron resistance wire is maintained with a certain tension in a hermetically sealed tube.

853,521. ELECTRODE; James H. Robertson, Arlington, N. J. App. filed July 24, 1906. A form of spring-plate device adapted to closely engage or clasp the human foot for the purposes of forming an electrode for a medical battery.

853,522. CABLE REEL APPARATUS FOR MINING LOCOMOTIVES; Harry W. Shaver, Pocahontas, Va. App. filed June 7, 1906. Relates to mining railroads of the type having cable wheel revoluble in a horizontal plane and operated by a small electric motor. Provides means by which a torque is exerted on the reel both when the locomotive is traveling away from the fixed conductor and when moving toward it.

853,550. ELECTRIC MACHINE; Coloman De Kando, Budapest, Austria-Hungary. App. filed Dec. 13, 1906. Has windings in a circular casing and an insulating mass adapted to melt at a predetermined temperature and embedding the projecting parts of the windings to prevent them from entering the space between the stator and roter.

853,552. ELECTRIC TOOL; Otis A. Kenyon, New York, N. Y. App. filed Oct. 23, 1906. A form of electric hammer having means by which the tool is immediately retracted after it has made its impact against the work, whether the tool meets the work early or late in the path of its normal stroke. This result is accomplished by having circuit opening means operated by the impact of the tool against the work and altogether independent of the stroke thereof.

853,556. TELEGRAPH TRANSMITTER; Charles W. Leiser, Salt Lake City, Utah. App. filed Feb. 15, 1906. A vibration arrester comprising a support having a vertical axis in its upper end, a cross pin in said recess, and a ring suspended loosely on said pin and adapted to receive the impact of the vibrator.

853,578. TELEPHONE-RECEIVER; A. F. H. Davis, Oakland, Cal. App. filed Nov. 23, 1905. The combination with an electro-magnetic telephone receiver, of a diaphragm therefor comprising solely a plate or disk of non-magnetic material, of relatively high electrical conductivity, substantially as set forth.

853,579. ALARM SIGNAL; Ellsworth E. Flora, Chicago, Ill. App. filed Mar. 8, 1906. A means for exploding a torpedo when a train passes over a certain point. Has a magnetic device operating to place the torpedo above the rail.

853,585. CONTROLLING DEVICE FOR ELECTRICALLY DRIVEN MACHINERY; Frederic O. Hunt, Darlington, England. App. filed Feb. 28, 1906. A controlling device for elevators in which it is desired to stop the car at a precise level under varing conditions of loads and speeds. Includes the arrangement of the circuits and the braking mechanism by which the elevator can be properly controlled by push buttons.

853,618. CIRCUIT CLOSING DEVICE; Rollin A. Baldwin, New Haven, Conn. App. filed July 19, 1906. A circuit closing device for trolleys adapted to complete a circuit through a magnet or other device when a trolley car passes a given point. Has two long, flexible strips which engage the side of the wheel in passing, whereby a good electrical circuit is made without any tendency to displace the wheel from the wire.

853,648. ELECTRIC CLOCK; Timothy B. Powers, New York, N. Y. App. filed May 12, 1906. Relates to secondary clocks in which the oscillations of the balance wheel are maintained by an electromagnet. Relates to features by which the magnet is momentarily energized to add an impulse to the oscillation of the wheel as a pole of the magnet approaches the armature.

853,655. PROTECTIVE MEANS FOR PARALLEL FEEDERS; Charles W. Stone, Schnectady, N. Y. App. filed Oct. 12, 1904. Relates to the protection of transmission systems employing feeders or transmission lines connected in parallel at both ends. Has means for cutting out one of the feeders or transmission lines at both ends in case it becomes short circuited.

853,672. HOLDER FOR THE RECEIVER OF A TELEPHONE; William A. Beavan, Philadelphia, Pa. App. filed Dec. 28, 1906. In a device of the character described, longitudinally extending arms, means for securing said arms together, a member deflected for an end of each arm forming a bifurcation, and a seat on each of said arms forming means for supporting a telephone receiver.

853,678. VAPOR ELECTRIC APPARATUS; William R. Burrows, Newark, N. J. App. filed July 7, 1905. A form of electrode designed to be used as an anode in electric apparatus, such as mercury vapor lamps and rectifiers. Has a curved exterior to provide a large superficial area and to facilitate the removal of gases from the interior.

853,682. TELEPHONE TRUNKING SYSTEM; William W. Dean, Chicago, Ill. App. filed June 28, 1902. Details of cord circuits of central exchange system.

853,688. ELECTRIC CONTROLLING SWITCH; Wilhelm Gminder, New York, N. Y. App. filed Aug. 26, 1905. A controlling switch interposed between a motor and other means to be operated and a controlling switch at a distant point. Is adapted to be actuated on closing the operating switch and adapted in turn to actuate the motor or other device.

853,694. ELECTRICAL SAD IRON HEATER; Charles Van D. Hill, St. Louis, Mo. App. filed Sept. 15, 1906. A flat box or casing is made with a hollow interior to receive a spirally wound resistance element, and means are provided for clamping a flat iron to the surface thereof.

853,703. MOTOR DRIVE; William F. Lautenschlager, Cincinnati, Ohio. App. filed Mar. 2, 1907. A motor drive having an operating lever supported about one of the bearings and a brake and movable contact lever moved by said lever in directions transverse to the longitudinal axis of the shaft.

853,711. MOTOR CONTROL; Wilbur L. Merrill, Schnectady, N. Y. App. filed Oct. 15, 1906. Relates to a system of controlling two electric motors of different capacities having low-speed gearing between the small motor and the load and high-speed gearing between the larger motor and the load, and a separate source of variable voltage for each motor.

853,736. CIRCUIT CLOSING DEVICE FOR BURGLAR ALARM SYSTEMS; William H. Robins, Minneapolis, Minn. App. filed Dec. 6, 1905. A means for preventing a burglar alarm gong being filled with sand or sound deadening substance so as to disable it without giving an alarm.

853,743. INSULATING DEVICE; Louis Steinberger, New York, N. Y. App. filed Mar. 29, 1906. An insulating device comprising a pin body provided with a stem for entering a cross arm and with a shoulder for forming a water-tight joint with said cross arm, said pin body being further provided with a water shield integral therewith and having a space intermediate said shoulder and said shield.

853,744. HIGH TENSION INSULATOR; Louis Steinberger, New York, N. Y. App. filed Mar. 28, 1906. A form of high tension insulator tube for heavy currents, and adapted to prevent, arcing from the line to the support under conditions where such arcing might otherwise take place.

853,745. HORIZONTAL SUPPORT FOR CONDUCTORS; Louis Steinberger, New York, N. Y. App. filed Dec. 10, 1906. A cylindrical circumferentially ribbed insulator adapted to support a plurality of cables of a high tension transmission system.

853,755. APPARATUS FOR TRANSMITTING TO A DISTANCE REAL OPTICAL IMAGES; Edouard Berlin, Paris, France. App. filed July 10, 1905. Has a continuously moving band and means for forming perforations of considerable diameter therein by means of electric sparks, the diameter of the perforations being proportional to the current impulses arriving at the receiving station.

853,765. OPERATING BULKHEAD DOORS; Arthur A. Buck, Schenectady, N. Y. App. filed May 20, 1904. Relates to the control of bulkhead doors designed to be simultaneously controlled from a single point. Has a manually operated reversing switch and means for maintaining said switch normally in its off position, an electromagnet for moving said maintaining means into a position to close said switch, and means located at a distant point for controlling the circuit of said electromagnet.

853,778. TRANSFORMER; John J. Frank, Schenectady, N. Y. App. filed Sept. 10, 1906. Construction of transformer having a winding provided with regulating leads near its center, whereby a central portion of the winding may be cut out of circuit.

853,784. RESISTANCE UNIT; H. E. Heath, Lynn, Mass. App. filed Sept. 22, 1006. A sheet of insulating material is perforated with a continuous series of openings, and the resistance wire is held to the face of the sheet by loops projecting at intervals into such openings.

853,780. MERCURY METER; F. Holden, London, England. App. filed Jan. 24, 1906. Relates to meters of the type having a liquid conductor in a magnetic field and producing displacement of the liquid thereby; has a tube of capillary dimensions included in the conductor through which the liquid circulates.

853,700. ELECTRIC MEASURING INSTRUMENT; F. Holden, London, England. App. filed Dec. 14, 1906. Relates to modifications of the above.

853,701. DOOR LOCK ELECTRIC SWITCH; W. E. Hughes, Seattle, Wash. App. filed July 17, 1906. Relates to electric switches, particularly switches designed for association with door locks, and so arranged that locking the door will open the switch and break the circuit.

853,770. THREE-PHASE TRANSFORMER; John J. Frank, Schenectady, N. Y. App. filed Sept. 19, 1906. Three-phase transformer of the "shell" type comprising a magnetic core, and three windings arranged in apertures in said core, one winding having its axis perpendicular to the line joining the centers of the other two windings.

853,780. SWITCH CONTROLLING MECHANISM; Henry Geisenhoner, Schenectady, N. Y. App. filed Feb. 27, 1906. Has a fan operated by the windage of the armature, and means for securing the fan in different positions in proximity thereto.

853,806. ELECTRIC PUMP; W. Lambert, Sunnyside, Wash. App. filed Oct. 3, 1006. Relates to means for automatically throwing both the pump and the electric mechanism out of action when the water in the tank reaches a predetermined level. Has two solenoids in alignment with one another, and a core common to both and movable longitudinally thereof.

853,818. AUTOMATIC TELEPHONE SYSTEM; F. Merk, Berlin, Germany. App. filed Jan. 2, 1907. Relates to detail features.

853,820. SYSTEM OF MOTOR CONTROL; W. S. Moody, Schenectady, N. Y. App. filed Oct. 20, 1905. Relates to the control of regulating switches for transformers and similar devices driven by electric motors, and provides means by which a careless operator will be prevented from leaving the switch-blade in a position bridging two adjacent contacts.

853,826. FIRE ALARM OR TEMPERATURE INDICATOR; M. L. Poulter, Stockport, Iowa. App. filed June 4, 1906. An air chamber having a diaphragm provided with a multiplying lever connection to an arm which is thereby impelled into position to close an alarm circuit.

853,838. CURRENT COLLECTOR; S. B. Stewart, Schenectady, N. Y. App. filed Aug. 1, 1906. A form of collective shoe for overhead trolleys of electric trains. The shoe is impelled upward in a vertical path by a spring impelled lazy-tongs device.

853,843. TRANSFORMER; M. O. Troy, Schenectady, N. Y. App. filed Sept. 21, 1906. A transformer is provided with a magnetic core and surrounded by a winding, and cooling pipes extending parallel with the winding axis between the winding and the core.

853,855. DESK-TELEPHONE AND SWITCHING MECHANISM; Albert K. Andriano, San Francisco, Cal. App. filed July 22, 1905. In a line-selecting local telephone outfit, the combination of a case, line contacts within the case, switching mechanism therein, a movable switch-piece co-operating with the said line contacts, and a rotatable transmitter adapted to form the setting means for the switch-piece.

853,877. BATTERY ELEMENT; Olis F. Harvey, Wilkes-Barre, Pa. App. filed Aug. 11, 1905. A form of grid for storage battery.

853,888. SYSTEM FOR ELECTRICAL DISTRIBUTION; R. C. Leake, Auburn, N. Y. App. filed Oct. 6, 1905. A tilting arm is made with a longitudinal chamber to loosely receive a ball or weight, so that when the arm is tilted by a magnetic device it will continue in such tilted relation by the displacement of the ball.

853,891. ELECTRIC RESISTANCE ELEMENT; A. L. Marsh, Lake Bluff, Ill. App. filed Jan. 17, 1907. An electric resistance element comprising a strip, strand or filament containing vanadium.

853,892. ELECTRIC WATER HEATER; E. C. Miles, Denver, Col. App. filed Feb. 11, 1907. A vertical cylindrical tank is provided with a vertical insulating plate through which a resistance element is threaded.

853,922. SWITCH; G. Gilmore, Alliance, Ohio. App. filed Sept. 18, 1905. A cock of a faucet has a plurality of metallic segments thereon which serve to close an electric circuit when the faucet is turned, and is employed to start an electric purifier in operation.

853,929. WIRELESS TELEGRAPHY; W. W. Massie, Providence, R. I. App. filed Nov. 4, 1905. Two oscillatory circuits are provided, one of which is opened and the other closed. There is a magnetic coil common to both circuits, and means are provided for adjusting the inductance and capacity of each.